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美容口腔医学

Aesthetic Dentistry

▶ David Bartlett
Paul A Brunton [编 著]

▶ 王 革 梁珊珊 [主 译]

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美容口腔医学

Aesthetic Dentistry

编　著　David Bartlett
　　　　Paul A Brunton
译　者　王　革　梁珊珊　等

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内容提要

“口腔临床要点快速掌握系列”是国际著名的Quintessence出版集团近期出版的介绍口腔各科基本技术和最新医学理论的专业丛书。该丛书自2002年起陆续出版发行，我社第一时间引进，以便国内读者同步了解国际口腔技术发展的新情况。《美容口腔医学》由国际知名口腔医学专家编写，摆脱了一般专著的照本宣科，一切从临床实践出发，通过大量实例，讲解了美容牙科学基本理论方法，详细介绍了漂白、微打磨、瓷贴面和复合树脂薄层技术，临床医师与技工室如何协作，以及对美学缺陷和问题的处理。本书采用了中英对照的编排方式，对提高读者的专业英语水平大有裨益。本书适合临床口腔科医师、技师和口腔医学生阅读。

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序

近年来，美容口腔医学在现代临床实践中呈现出持续而迅猛发展的态势。如今患者对牙齿美观的高度重视已成为牙科常规治疗的重要目标之一。然而，实现该目标无疑是具有挑战性的。为了能够通过适当的方式成功处理不美观的牙齿，并能够经受口腔环境的严格考验，使患者拥有满意的微笑，要求我们必须具备传统与现代牙科艺术与科学的双重技巧，掌握影响个体牙齿外观与整体牙齿外观的各种因素的相关知识与理念。这是一个复杂的课题，"口腔临床要点快速掌握系列"丛书在这方面进行了完美补充。

与丛书中的其他书一样，美容牙科学重点阐述了该主题的重要性，采用大量优质的图片分类说明贯穿全文，用以强调原则、要点、关键技术以及常见错误。现在，美容牙科学的重要性已经在临床实践中得到了公认，临床操作已不再局限于3R原则[修补、去除、替换(repair, removal and replacement)]。本书涉及了日常牙科诊疗的基础知识和指导原则。

如同许多牙科临床工作一样，良好的治疗效果源于医患之间的互相信任和理解、有效的沟通、前沿的知识、谨慎的治疗计划、精确的治疗操作。美容口腔医学并不容易掌握，有相当高的要求。本书提供了一种有效的工具，帮助我们达到这一目的。对于那些为希望改善牙齿外观患者服务的牙科医生和医学生来说，这本书的确是物有所值。

主　编　**Nairn Wilson**

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前　言

本书的目标并不是要成为美容口腔医学领域的权威教科书。在该领域已经有数本集大成的著作。本书以对照的形式，设计成一本成功治疗的备忘录，它为临床医师提供了一些操作技巧和提示，以提高他们日常的口腔美容操作技术，同时也介绍了一些基础理论。除了从美容学角度探讨以外，本书不详细讲述任何一种间接修复体。这方面内容读者可以参考一些详细介绍间接修复体的专业书籍。此外，本书的附录列举了一些作者认为有用的材料和设备。

通过阅读本书，读者可以：

- 理解微笑的组成和变化
- 搞清楚色彩理论以及它是如何影响比色和颜色的传递的
- 合理选择活髓和死髓的漂白病例
- 考虑采用微打磨技术去除牙面不美观的缺陷
- 用树脂进行成功的前牙贴面修复
- 提供成功的瓷贴面修复
- 了解技术因素、技工室因素以及牙周因素如何对美观产生影响
- 尽量减小对美观的损害
- 解决常见的美学难题

David Bartlett
Paul A Brunton

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致　谢

作者对David Ricketts医生对全书的审读以及提出的反馈意见表示感谢，同时感谢Selina Priestley小姐审读了本书第2章。

此外，以下一些同仁慷慨地提供了许多图片，使得本书得以出版：Leean Morrow小姐提供了图1-6，1-7和7-6；David Leedham提供了图2-7～2-9；Tim Horwood提供了图4-5，4-6，5-5和6-5；图6-4，6-6和7-3是得到George Warman（英国）出版有限公司同意后从Dental Update上复制的。图6-1是征得British Dental Journal同意后复制的。

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第 1 章 微笑参数

Smile Dimensions

目　的

为了成功实施美容牙科学，很重要的一点是熟悉并牢记"理想微笑"的重要构成。所谓"理想微笑"是一个既包括以患者的治疗为基础，又包括对病人的个性化治疗意识的概念。本章的目的是使从业医师掌握"理想微笑"的参数及其构成。

Aim

To practise successful aesthetic dentistry it is important to be familiar with the essential components of an "ideal" smile – remembering of course that the "ideal" smile is a concept around which all patient treatment is based and that every patient requires an individual approach. The aim of this chapter is to acquaint practitioners with the dimensions and components of an "ideal" smile.

要　点

通过阅读本章，从业医师将能够评价患者的个性化微笑中冠和其他修复体的外形及其相互关系。

Outcome

On reading this chapter practitioners will be able to assess the shape and inter-relationship of crowns and restorations within the framework of a patient's individual smile.

引　言

牙科美学可以从两个水平来看待：一个是会话水平，一个是牙齿水平。会话水平考虑的是在牙齿整个面部中的排列情况以及微笑时牙齿的排

Introduction

Aesthetics can be viewed at two levels – the conversational and tooth levels. The conversational level considers the arrangement of teeth within the framework of a

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列情况；牙齿水平则要考虑通过美学处理使牙齿看起来逼真的每个细节。牙齿做得逼真很重要，但合适的牙齿结构比例也同样重要。为了达到这种效果，从业医师必须熟悉与微笑有关的各种因素，包括：

- 牙齿大小
- 黄金比例
- 牙龈位置
- 黑三角
- 唇线
- 牙龈组织遮盖
- 医学道德问题

牙齿大小

上颌切牙的平均宽度一般是其长度的75%，否则会影响美观（图1-1）。但对牙齿外形的感觉却因人而异。例如，有的人牙齿狭窄并有间隙，但他们本人可能很满意。但是，假如患者发现牙齿的外观难以接受，并计划用新的牙冠改变上切牙时，就有必要考虑用此规则（牙冠宽为冠长的75%）来计算牙齿的宽度。在改变牙齿的宽度和长度之前，必须使用诊断蜡型来评估所提出的牙齿改形方案。如有必要，在进行最终的治疗之前，还可以用复合树脂直接修复术，以对该牙的最终外形进行短期或中期的评估（图1-2）。由于目前复合树脂的修复效果美观，常

face and an individual's smile. The tooth level is the consideration of everything that makes a tooth look like a tooth. It is important that teeth should look like teeth, but equally it is important that teeth are appropriately framed. To do this effectively a practitioner must be familiar with the dimensions of a smile, to include consideration of the following:

- tooth size
- the golden proportion
- gingival position
- black triangles
- lip line
- masking gingival tissues
- moral issues.

Tooth Size

On average, the width of an upper incisor tooth is 75% of its length and where this is not the case the result is generally unaesthetic (Fig 1-1). The perception of tooth shape, however, is very personal. For instance, someone with narrow teeth and diastemas might be quite content with their appearance. But if the patient found the appearance unacceptable and new crowns were planned for the upper incisors, it may be worthwhile to consider using this rule (width based on 75% of length) to calculate tooth width. Before any changes to width and length are embarked upon, it is essential that a diagnostic wax-up is used

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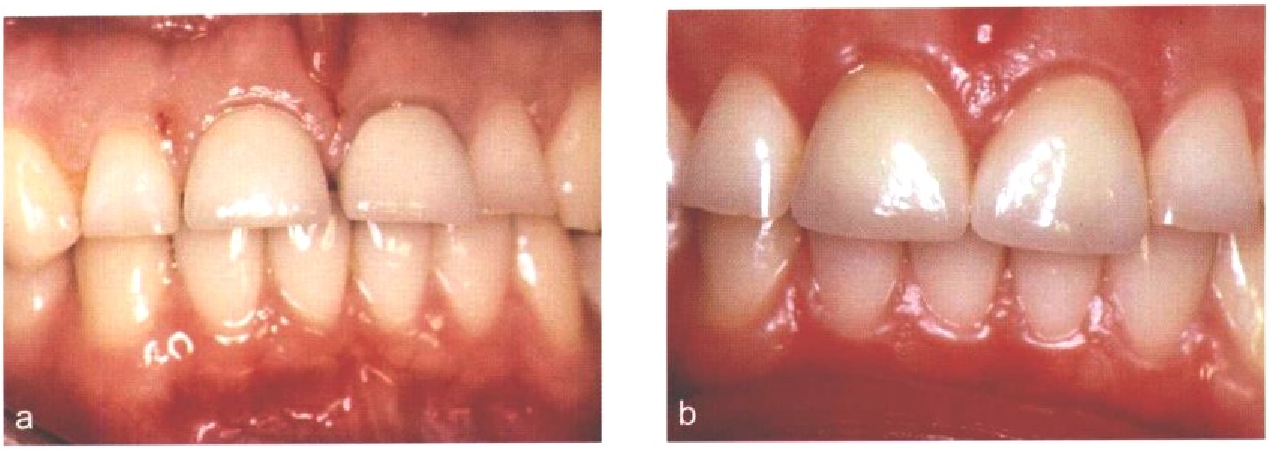


图 1-1 a. 长宽相等的牙冠不美观；b. (治疗后)用长宽比例合适的牙冠替代
Fig 1-1 (a) Unaesthetic crowns where the width and length of the crowns are equal. (b) Replacement crown of appropriate dimensions.

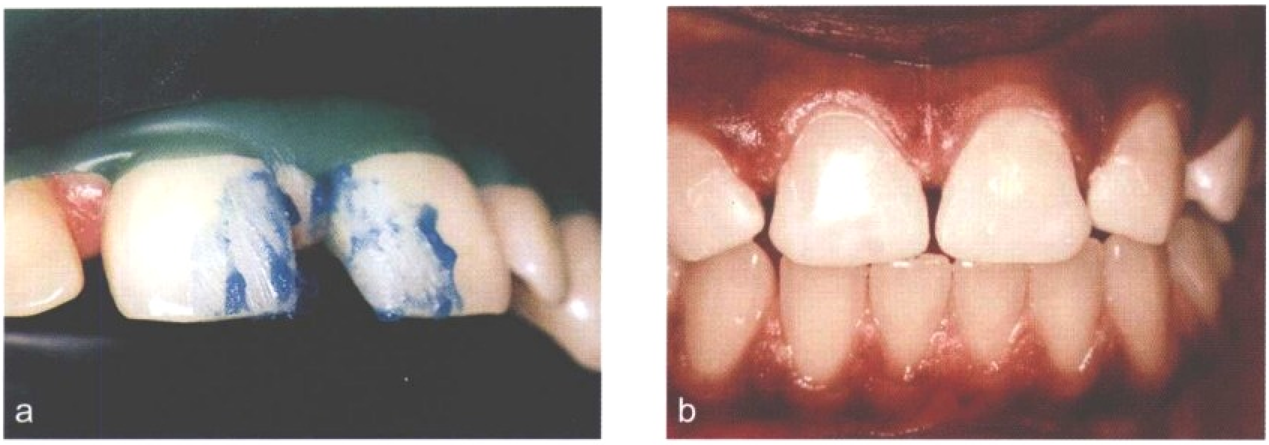


图 1-2 a. 酸蚀后用复合树脂减小年轻患者的牙间隙；b. 治疗后间隙减小
Fig 1-2 (a) Etch placed to reduce a diastema with resin composite in a young patient. (b) Post-treatment reduced diastema.

常使患者放弃最终的修复。

长宽比例会影响对间隙关闭的判

to assess the proposed changes to a patient's appearance. If necessary, directly placed resin composites can be used either for the short or medium term to assess the final appearance of the teeth before proceeding to the definitive treatment (Fig 1-2). The aesthetics of present-day resin composite often make the definitive stage of treatment unnecessary.

The width-to-length ratio influences the

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断。如果宽度与长度的比例原本已经大于75%，那么通过加宽牙齿来减小间隙可能会使牙齿外形显得更加难看。对于牙冠窄且容易加宽的牙齿来说，可以采用这种方法来关闭间隙，但是，对于牙冠宽大的牙齿，则需要考虑其他因素。在这种情况下牙冠下方的牙龈组织的位置就成为另一个重要的评估因素。

judgement to close diastemas. If the ratio of the tooth is above 75% then widening the tooth further to reduce the space may produce an appearance that is unacceptable. The compromise and closure might be acceptable for a narrow tooth that could easily be widened, but for a broader tooth other factors may need to be considered. In such cases the location of the gingival tissues down the length of the crown is another assessment that is important.

临床医师通常会将牙齿外形和性别联系起来。女性的牙齿可能较窄，而男性的较宽。这种划分一点也不精确，在设计桥支架或者间接修复体时，临床医师通常参考其他现存的牙齿来确定修复体的外形和轮廓。这里介绍几种技术小窍门，可以用来遮盖或模糊技工室制作的牙冠的角度。水平中线使牙冠看起来较短，而垂直线则可使加宽牙冠的邻面角变窄（图1-3）。另外，如果间隙太宽，可以使用一个远离邻面的锐角，在视觉上产生牙冠变窄的假象（图1-4）。

Traditionally, some clinicians have linked tooth shape with gender. Narrower teeth may be found in females, broader ones in males. This demarcation is by no means accurate, and when bridgework or indirect restorations are planned clinicians normally have the advantage of other standing teeth to guide decisions on the shape and contour of the restoration. There are various technical tricks that can be adopted to hide or attenuate the angles of laboratory-made crowns. Mid-line horizontal lines appear to shorten the crown, while vertical ones nearer the proximal angles would broaden it (Fig 1-3). Additionally, if the space is too wide an illusion can be created by introducing sharp angles away from the proximal surface to make the crown appear narrower (Fig 1-4).

最重要的美学评判标准取决于患者。对颜色和外形的感觉在某种程度上与年龄有关。年长者通常认为较大

The most important criterion in making a judgement on aesthetics is the patient. The perceptions of colour and shape are some-

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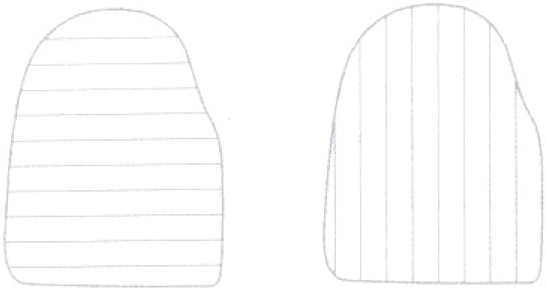


图1-3 和垂直线相比，水平线使同样大小的牙齿的牙冠显得较短

Fig 1-3 Horizontal lines make the identical crown appear shorter than the crown with the vertical lines.

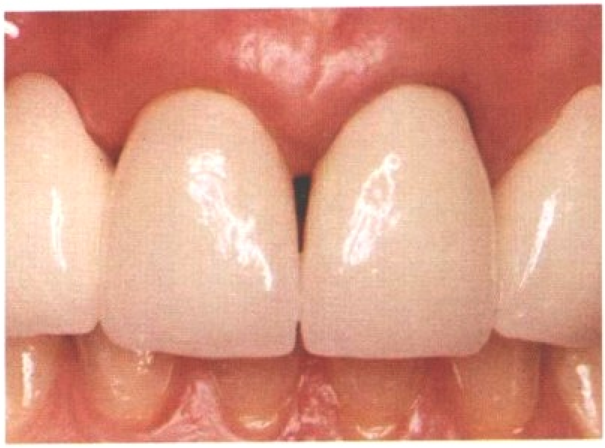


图1-4 圆钝或平滑的接触区可以使牙冠变宽，而对于牙冠过宽的牙齿，使远离接触点的角更明显，也可产生牙冠变窄的假象

Fig 1-4 A rounded or smooth contact region can make the crown appear broader, but for one that is too broad making a more pronounced angle just away from the contact point creates the illusion of a narrower crown.

较亮的牙齿是年轻的标志。遗憾的是，越来越多的患者在比色时选择偏亮、偏白的颜色，甚至比B1颜色更浅。对于很多从业医师而言，这种颜色很不自然，但是，越来越多的患者希望或要求使用这一类颜色。如果选色是经过慎重考虑的，那么术前就应该经过充分的讨论，并且给患者一个明确的建议：什么颜色看起来可能更适合他们微笑的外观效果。

黄金比例

正常情况下，侧切牙比中切牙小，

what age-related. Senior patients commonly perceive bigger and brighter teeth as indicative of youth. Unfortunately, there is an increasing trend to achieve brighter and whiter teeth producing shades that are lighter than B1. The result for many practitioners is too artificial, but increasingly patients expect and demand shades at this end of the spectrum. If such a shade is contemplated, considerable discussion should occur preoperatively and the patient should be given a clear idea what the shade is likely to look like within the parameters of their individual smile.

The Golden Proportion

Normally lateral incisors are smaller than

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如果它们大小相差不多，这在美学上是不能接受的。采用黄金比例的概念来平衡尖牙、侧切牙和中切牙。黄金比例是公元前300年欧几里得提出的一个定律，现将其应用于牙科美学中。中切牙和侧切牙的黄金比例，侧切牙和尖牙的黄金比例已得到了充分证明（图1-5）。简单地说，中切牙的宽度是侧切牙的1.618倍。可以根据中切牙的宽度，利用网格图来确定患者微笑的宽度。认识比例关系的大小是十分重要的，例如，中切牙的宽度和侧切牙的宽度比是黄金比例，而且，中切牙和这两个牙齿宽度之和的比例同样是黄金比例。按照黄金比例设计的牙齿，其微笑的效果是令人满意的，这一点已经得到了一致的公认。

centrals, and if their comparative size starts to become equal the result can be aesthetically unacceptable. The golden proportion adopts this concept with a balance between the canines, laterals and central incisors. The golden proportion was formulated as one of Euclid's elements *c*. 300 BC and it applies to dental aesthetics. This is amply illustrated by the fact that the central incisors are in golden proportion to the lateral incisors, which in turn are in golden proportion to the canines (Fig 1-5). Put simply, the central incisor is 1.618 wider than the lateral incisor. It is possible using grids that are based on the width of the central incisor to determine the width of a patient's smile. It is important to recognise that the proportion of the smaller to the greater – for example, the width of the central incisor in relation to the width of the lateral incisor – is golden but so also is the width of the central incisor in relation to the com-

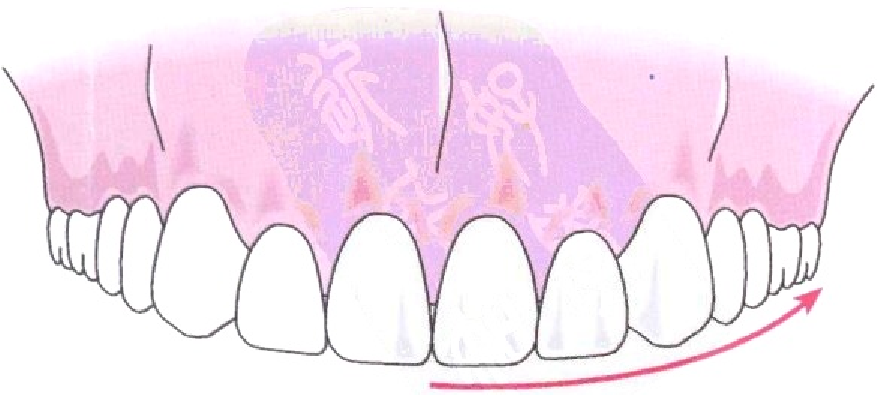


图 1-5 符合黄金比例的牙齿

Fig 1-5 Teeth in golden proportion.

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患者微笑的宽度和面部其余部分应符合黄金比例。微笑时前牙美学区由嘴唇及牙齿和嘴角之间的间隙构成，这个中性间隙区总是被外形过大的牙齿或做得过宽的牙弓充满。如果失去了这个中性间隙区，微笑就很不美观。理想的状态是前牙美学区的宽度和微笑的宽度符合黄金比例，且前牙的中线和面部中线一致。

bined widths of the two teeth. It is accepted that when teeth are set up so that the proportion is golden within the confines of the smile it is aesthetically pleasing.

The width of a patient's smile is in golden proportion to the rest of the face. Upon smiling the anterior aesthetic segment is framed by the lips and there is space between the teeth and the corners of the mouth. This neutral space is all too often filled with over-contoured teeth or dental arches that have been made too wide. If this neutral space is lost the smile is not aesthetically pleasing. The width of the anterior aesthetic segment is in golden proportion to the width of the smile, ideally with the midline coincidental with the midline of the face.

牙龈的位置

健康的上颌侧切牙的牙龈位置比中切牙和尖牙更接靠近殆平面一些。不管是在天然情况下，还是在牙齿磨耗以后牙槽骨代偿作用下，这个位置都可能发生改变，导致侧切牙的牙龈高度和中切牙的高度一样。牙齿未磨损时牙龈的梯度外形给人以自然和愉悦的感觉，并且可以使上颌中切牙显得比较突出，产生较好的美学效果（图 1-6）。尽管通过冠延长术以形成牙龈的梯度外观的方式是存在疑问的，但是，如果冠延长术是磨耗牙治疗计划的一部分，那么将牙龈位置形成梯度

Gingival Position

The gingival position on the upper lateral incisors in a healthy state is closer to the occlusal plane than on the central incisors and canines. Either naturally, or as a result of tooth wear and dentoalveolar compensation, this position may alter and result in the lateral incisors having a similar height to the incisors. The unworn step effect produces a natural and pleasing appearance and can accentuate the dominance of the upper central incisors, providing an acceptable aesthetic result (Fig 1-6). Whether it is acceptable to undertake crown

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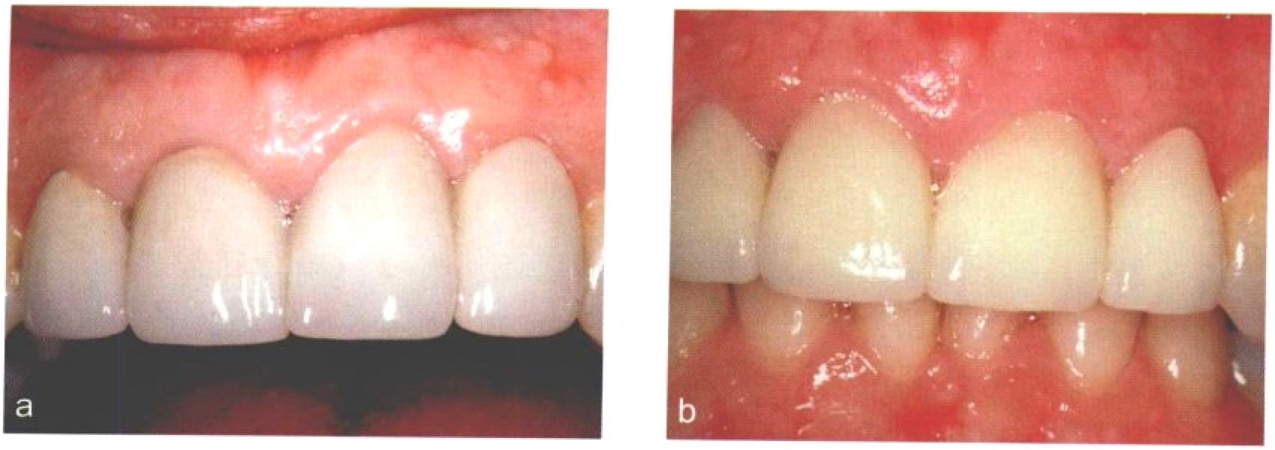


图 1-6 a. 牙龈高度不一致使牙冠不美观，牙齿之间的比例不正确；b. 冠延长术后为患者做新的牙冠

Fig 1-6 (a) Unaesthetic crowns with unequal gingival heights and teeth in incorrect proportion to each other. (b) New crowns provided for the patient after crown lengthening surgery.

外观则是值得考虑的。

龈缘的位置要对称。如果患者唇线较低，单侧牙龈退缩可能不会产生临床问题。但是，对于某些唇线高的患者，牙龈高度的不一致就会影响前牙的外观（图 1-7）。但是，以调整牙龈的位置为目的的手术内容不在本书范畴之内，读者可参考牙周病学的专业教材。然而，这个问题应该在制定治疗计划阶段就进行考虑，适当的时候可以向牙周病学专家求助。

lengthening surgery to produce this step height appearance is doubtful but if, for instance, surgery was planned as part of the treatment for tooth wear, placing this step in the gingival position is worth considering.

The location of the gingival margin needs to be symmetrical. Unilateral gingival recession may not create a clinical problem if the patient has a low lip line. But in someone with a high lip line, unequal gingival contours may compromise the appearance of the anterior teeth (Fig 1-7). Surgical procedures aimed at adjusting the gingival position are, however, outside the remit of this book and readers are referred to a specialist textbook in periodontics. This problem, however, should be considered at the treatment-planning stage and help sought from a periodontist, if appropriate.

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避免牙周问题的关键措施也许就是控制牙体预备中龈缘的位置。将龈缘放在过于龈下的位置将会导致慢性牙周问题。特别是对易患牙周病的患者，很可能导致牙龈退缩，进而使原本位于龈沟内的边缘暴露出来（图1-8）。最常受其影响的牙体预备区域是牙间区。牙间的牙龈乳头被切割是相当常见的现象，这样做可能易于取模，但可能造成唇侧龈缘的不稳定。如果患者属牙周病的易感人群，则必将引起牙间区局部的牙龈退缩，进而导致唇侧龈缘不稳定，并使牙龈的位置迅速改变。所以，最合适的龈缘位置恰恰是在龈沟内，既满足隐藏边缘的要求又不引起牙龈炎症。在设计牙体预备的边缘位置时，应记住仅仅有33%的人群在微笑时显露牙体龈方1/3部分（图1-9）。预备体边缘近牙龈的设计适合这类人群。

Perhaps the most avoidable periodontal problem is where the gingival margin of the preparation is placed. Placing preparation margins too subgingivally will result in a long-term periodontal problem. This is especially the case if the patient is susceptible to periodontal disease, as this might well result in gingival recession, thereby exposing margins that had previously been placed within the gingival crevice (Fig 1-8). One area of the preparation most commonly affected by this is the interdental region. Cutting through the interdental papilla is quite common and, while this may not make the impression-taking too difficult, it might result in the labial gingival margin becoming unstable. If the patient is susceptible to periodontal disease then this will cause localised recession in the interdental area, but unfortunately this



图 1-7 牙龈形态不一致

Fig 1-7 Unequal gingival contours.



图 1-8 根面平整术后牙龈退缩，露出牙冠龈下不适合的边缘

Fig 1-8 Recession post root planing, showing ill-fitting crowns placed with

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change will result in an unstable gingival margin labially too and as a result the gingival position may change quite quickly. Therefore the most appropriate position for the margin is just within the gingival sulcus, sufficient to hide the margin but not to encourage gingival inflammation. When positioning the margins of preparations, bear in mind that only 33% of the population show the gingival third of their teeth when they smile (Fig 1-9). Juxtagingival preparation margins would be appropriate with this group of patients.

黑三角

对许多从业医师和患者来说，牙齿间的黑色三角间隙是不能接受的，因为该三角间隙和年龄的增长有关（图1-10）。但是，这个问题很难解决。如果牙齿太窄，可采用复合树脂直接修复术、烤瓷贴面或冠修复等方法加

Black Triangles

For many practitioners and patients the appearance of the black triangle between teeth is unacceptable, as it is associated with ageing (Fig 1-10). It is, however, difficult to overcome. If the tooth is narrow then broadening the crown with direct resin

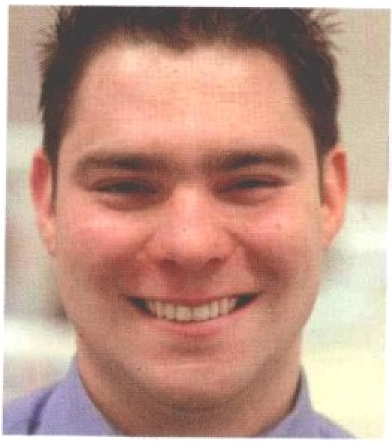


图1-9 大多数人微笑时不显露牙齿的龈1/3

Fig 1-9 Gingival third is not visible when most people smile.



图1-10 牙周疾病形成的黑色三角间隙

Fig 1-10 Black triangles post periodontal disease.

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宽牙齿以减小黑色间隙。在修复之前对原始牙冠的宽度进行评估很重要。对已经过宽的牙齿再予增宽是不明智的，而对牙冠较窄的牙齿可以考虑适度增宽。另一个重要的评估内容是近牙龈缘的位置：

- 如果牙冠宽长比例在75%～85%，可通过加宽牙齿来填补部分牙龈组织以减小三角间隙。如果仍然无法预测加宽后的效果，还可以通过诊断蜡型，采用复合树脂直接修复法做暂时修复或中期修复，以评估牙齿宽度改变的效果。简单地说，可以用树脂加强型玻璃离子，或者用免酸蚀的低黏度复合树脂辅以粘结介质，添加在牙齿上以修改其外形。这些材料在以后需要时可以很容易地去除。

- 评估预备牙牙龈组织的邻面高度。如果牙龈退缩是局部现象，可以将牙龈向殆向重新定位，以减小牙间区的影响，但治疗结果的稳定性值得怀疑。如果牙龈退缩范围太广，重新定位牙周组织成功的可能性很小。

composites, porcelain veneers or crowns may hide some of the black area. It is important, however, to assess the original width of the crown before this is contemplated. It is not sensible to widen a tooth that is already too broad, whereas with a narrow tooth a degree of change can be contemplated. Another important assessment is the location of the adjacent gingival margins:

- If a ratio of around 75–85% of length to width is possible the tooth can be widened to bulk out the gingival tissues and so hide the triangle. If the result is still not predictable, even with a diagnostic wax-up, direct resin composite build-ups can be used either provisionally or for the medium term to assess changes to the width of teeth. For simplicity, a resin reinforced glass ionomer or a low-viscosity resin composite without etching and a bonding agent can be added to the tooth to alter the shape. When needed the material can then be simply removed.

- Assess the proximal height of the gingival tissues of the teeth to be prepared. If the recession is a localised phenomenon it might be possible to relocate tissues occlusally to reduce the impact of the interdental area; however, the stability of the result is questionable. If the recession is more generalised,

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relocation of the periodontal tissues is less likely to be successful.

- 确定釉牙骨质界的位置很重要。如果预备体的龈缘位置在龈下，那么，牙龈就可能向根尖方向再定位。如果牙周组织明显低于釉牙骨质界，那就不能向根向定位了。

- It is important to determine the position of the cementoenamel junction. If the margin is below the gingival margin then some degree of flexibility may be possible in relocating the tissues in an apical direction. If the periodontal tissues are significantly below the cementoenamel junction then this would not be possible.

- 可以考虑用正畸的方法使牙齿挤入或拉出，以改变它与其他牙齿之间的关系。这种移动的稳定性需要仔细考虑，可能还需要辅以牙齿外形的调整，以维持𬌗关系的稳定。

- It may be possible to consider orthodontic movement to intrude or extrude the tooth to move its relationship with the other teeth. The stability of such movements needs careful consideration and may require to be accompanied by modification of tooth shape to maintain occlusal stability.

- 如果伴有部分牙齿缺失，例如种植体支持式固定桥，桥体可以盖过牙龈，以形成良好龈缘外形。这种被称为卵圆形桥体的修复方法非常成功。

- In cases in which teeth are missing, such as implant-supported bridges, the pontic can be overbuilt to create an acceptable gingival contour. These so-called ovate pontics can be quite successful.

唇　线

在正常功能状态下，切牙关系为Ⅰ类和Ⅱ类的患者，在典型微笑时上切牙大约1/3的部分可以看见，这种显露是一种令人愉悦的表情。切牙关系Ⅲ类的患者，下切牙显露过多，这种外形通常不被认可。

Lip Line

In a typical smile about a third of the upper incisors are visible in patients with Class I or II incisal relationships during normal function, and this display is pleasing. In patients with a Class III incisal relationship, where the lower incisors are

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患者显露的牙齿过多会产生一些美学问题，如某些人唇线过高。这种情况对医师的美学观念要求更高。无论修复体边缘放在哪里，最终都会暴露出来。因为，即使最初的牙周组织很健康，随后都会发生一定程度的牙龈退缩。当牙龈组织向根方迁移后，修复体边缘就会显露出来。对于根充后变色的牙齿，这种情况就显得非常难看，而且不易改变。如果该现象发生后重新预备牙体，向根方去除更多牙本质，那么牙冠就会变长，同时还可能变窄。这会削弱牙齿的强度，更会影响牙齿以后的活力。通过牙周手术也许可以改变牙龈的位置，但效果不稳定，尤其是长期效果。对于临床牙冠过长的牙齿，需要考虑遮盖的方法。

牙龈组织的遮盖

对从业医师而言，这可能是最困难的临床问题之一。在健康的口腔中，牙龈组织定位丧失可以通过移植术治疗。其效果的稳定性因人而异，而且，

more prominent, this appearance is generally not attainable.

Different problems start to develop when the patient displays too much of the teeth—for instance, someone with a high lip line. The aesthetic demands in such cases are much greater. Wherever the margins of the restorations are placed they will eventually become visible. This is because, in time, even with the best periodontal health at baseline, there will be some gingival recession. As the gingival tissues migrate apically the margin of the restoration will become more visible. On darkened root-filled teeth this appearance can be unsightly, but is difficult to change. If the tooth is then reprepared by cutting away more dentine apically, the crown of the tooth becomes longer and may become too narrow. This can also weaken the tooth, let alone affect the subsequent vitality of the teeth. Some changes to the position of the gingivae may be possible with periodontal surgery but the result may not be stable, particularly in the long term. For teeth that have very long clinical crowns masking procedures need to be considered.

Masking Gingival Tissues

This is perhaps one of the most difficult clinical problems for practitioners. In a healthy mouth loss of localised gingival tissues may be treated by means of grafting.

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患者能否保持口腔健康也是一个重要的影响因素。但是，如果不能进行再定位术，则需要选择其他的方法，遗憾的是所有这些方法都有一定的危害。最有效的软组织替代品是丙烯酸，其边缘薄，并可以隐没到毗邻的牙龈组织中（图1-11）。粉红色瓷可加在牙冠的龈面以模拟牙龈组织的形态，但是这种方法仅适用于需要少量添加的病例。所需的瓷量也是一项需要考虑的重要内容，如果加瓷太多，将会很难控制烧瓷后瓷冷却过程中瓷块出现裂纹。最困难的情况是唇线过高并伴有严重的牙龈退缩，这种情况建议采用可摘丙烯酸牙龈罩（假牙龈），但是这对于患者很不方便，不但需要经常取下清洗，而且还可能引起菌斑堆积导致牙龈进一步退缩。

How stable the result is will vary from patient to patient and their ability to maintain their oral hygiene is an important consideration. However, when relocation surgery is not possible alternatives are necessary, and unfortunately they are all compromises. The most effective soft-tissue replacement is acrylic, which is thinned at the edges and made to merge in with the adjacent tissues (Fig 1-11). Pink porcelain can be added to the gingival surfaces of crowns to mimic the gingival tissues but is only really effective in very small additions. An important consideration is the bulk of the porcelain needed. With too much it will be difficult to control the cooling of the porcelain after firing, and the bulk of porcelain may fracture. The most difficult situation is considerable recession with a high lip line. In these situations removable acrylic gingival masks have been suggested, but these are inconvenient for

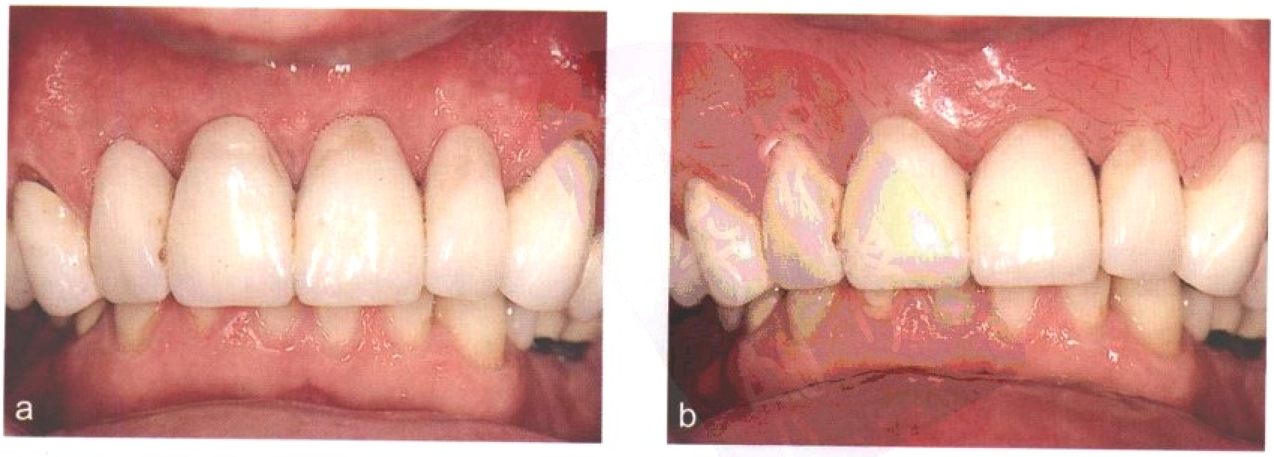


图 1-11 a. 牙龈退缩；b. 同一患者戴用牙龈罩（假牙龈）后

Fig 1-11 (a) Gingival recession. (b) Same patient with a gingival mask in place.

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patients as they have to be removed regularly for cleaning, let alone plaque accumulation, which may cause more gingival recession.

医学道德问题

虽然对于某些人"理想微笑"是一个合理的选择，但是对于其他人来说则可能是治疗过度。因此有必要权衡利弊。全面的治疗计划包括倾听患者的主述，理解他们的需求，还要综合考虑技术上的可行性、治疗价格以及医师的临床技能。有些从业医师利用图像处理技术将临床治疗后的效果展示给患者。这种方法有一定的帮助，但应该记住，临床治疗的最终结果不可能和图像处理的效果完全一样，而且这种方法可能会提高患者对治疗效果的期望值，因此并不一定是一种明智的方法。诊断蜡型能帮助患者提供修复效果的术前指导，并且可以避免过多地提高患者的期望值，但是作为诊断工具则显得有些粗糙。利用患者年轻时的照片也是很有用的，但遗憾的是没有哪个牙医可以逆转老龄化的进程。

Moral Issues

Although the "ideal smile" may for some be an appropriate choice, for others it could be considered over-treatment. So it is essential to strike the appropriate balance. Comprehensive treatment planning involves listening to the patient and understanding their needs in combination with consideration of possibilities of the techniques available, cost of treatment and a practitioner's clinical skill. Some practitioners are using photo-manipulation to show patients the anticipated result of a clinical treatment. While this can be helpful it should be remembered that the end result clinically is never as predictable as the manipulated image, and it may be unwise for patients to have raised expectations for a treatment. A diagnostic wax-up can provide a helpful preoperative guide to the end result without increasing the expectations too much, but as a tool it is somewhat crude. Using photographs of patients when they were younger can also be helpful, but unfortunately no dentistry can reverse the ageing process.

不论选择哪一种治疗方法，患者都需要充分理解治疗的理念和所选择

Whichever treatment is chosen, the patient needs fully to understand the treatment

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的方案。为了做到这一点，用文字描述治疗效果和治疗方案是非常有必要的。明智的做法是不要在第一次就诊时就选择治疗方案，尤其是对于那些较复杂的治疗方案更是如此。千万不要忘记用文字记录下每一个细节，可能的话拍摄临床照片，这不仅可以帮助临床诊断还可作为治疗的记录。

concepts and choices. To do this a letter describing the planned outcomes and the choices is mandatory. It is sensible not to choose the options at the first visit. This is especially true for more complicated procedures. Never forget to document everything and, where possible, take clinical photographs, not only to help with the diagnosis but also as a record of treatment.

拓展阅读

Further Reading

Levin EI. Dental aesthetics and the golden proportion. J Prosthet Dent, 1978, 40: 244–252

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第 2 章 牙色选择与颜色传递

Shade and Colour

目　的

成功的比色和颜色的传递是从业医师的主要困难。本章旨在增强对现代比色术和颜色传递的认识，同时还将简述形状和外形在美学成功中的重要性。

Aim

Successful shade-taking and colour communication are sources of great difficulty for practitioners. The aim of this chapter is to improve understanding of modern methods of shade-taking and colour communication. The importance of shape and form in successful aesthetics will also be outlined.

要　点

从业医师将理解颜色的理论基础，熟悉如何正确比色，理解形状和外形对美容牙科学的影响。

Outcome

Practitioners will understand the basics of colour theory, be familiar with how to take a shade effectively and understand how shape and form can impact on aesthetic dentistry.

引　言

颜色可以用色相、色度、明度三个元素来描述，定义如下：

- 色相——颜色的类型（如红、绿、蓝）
- 色度——色相的深浅或者饱和度

Introduction

Colour can be described as having three components — hue, chroma and value — which are defined as follows:

- Hue - type of colour (for example, red, green, blue).
- Chroma - depth or saturation of the hue

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（如粉色）

•明度——色相的亮度（如灰或白）

这些元素可以在一个被称为色球的三维空间上分类。X、Y和Z轴在不同的点上交汇便产生不同的颜色。临床上，在为复合树脂直接修复体以及树脂牙冠等牙色修复体比色时，颜色是一个重要的考虑内容。同样，在某患者口内，所有的牙齿可能都有相同的色相（颜色），但是色度（色相的深浅或饱和度）却可能彼此不同。例如，在同一患者口内，尖牙比侧切牙黄一些。其深层颜色可能是一样的，只是尖牙的釉质和牙本质较厚，使得颜色显得较深罢了（图 2-1）。同样，一颗牙齿不同部位的颜色也不相同，颈部常看起来比切缘颜色深。同样的原因，在牙弓中越靠后的牙齿越暗。例如，侧切牙看起来较中切牙暗，因为釉质的厚度大大减小，特别是在颈缘区。最终，对牙齿颜色起决定作用的深层牙本质的颜色会逐渐显露出来。

(for example, pink).

• Value - brightness of the hue (for example, grey or whiteness).

The components can be classified on a three-dimensional (3D) scale called a colour sphere. The X, Y and Z axes meet at various points to produce a colour. In clinical practice colour is an important consideration when choosing the shade for tooth-coloured restorations such as direct resin composites and crowns. Equally, in an individual patient the teeth may all have the same hue (colour) but the chroma (depth or saturation of the hue) may differ from one tooth to another. For example, a canine can appear yellower than a small lateral incisor in the same patient's mouth. The underlying colour may be the same, but in the canine the thickness of enamel and dentine is greater, which gives a darker colour (Fig 2-1). Similarly the shade of a tooth varies within the tooth in that the neck usually appears darker than the tip. Teeth, for the same reasons, become darker the further back they are in the dental arch. For

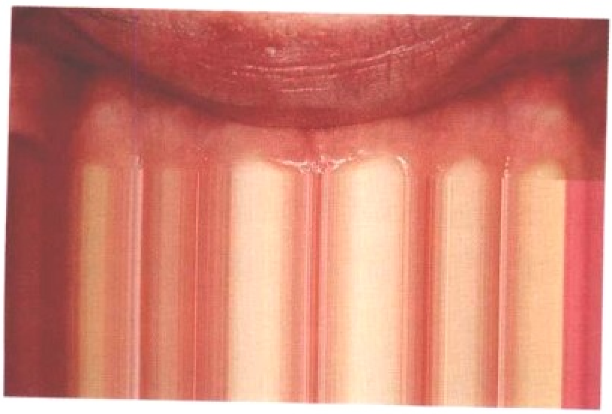


图 2-1 尖牙较切牙暗

Fig 2-1 Canines are darker than the incisors.

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example, lateral incisors appear darker than central incisors because the thickness of the enamel is much reduced, especially in the cervical area. Consequently the underlying dentine, which is largely responsible for the colour of a tooth, comes to the fore.

牙齿的磨损同样会引起颜色的改变。当某一颗牙齿受到损伤、磨耗或者腐蚀等因素单独或联合作用时，剩余的釉质和牙本质厚度会逐渐变薄。牙体颜色的饱和度或者色度的变化，受牙齿深层牙本质颜色的影响更加明显。人们常常认为牙齿随着年龄的增长而变黄。事实上，它们并不是变黄，只是看上去如此，因为表面釉质增龄性变化，使深层牙本质显得更不透明。

Colour changes also occur as a result of tooth wear. As a tooth is affected by abrasion, attrition or erosion, either in isolation or in combination, the thickness of the remaining enamel and dentine gradually reduces. The colour saturation or chroma changes as the effect of the colour of the underlying dentine again becomes more dominant. Often teeth are described as becoming more yellow with age. They are not in fact more yellow, they just appear so as the underlying dentine becomes more opaque (less translucent) through age-related sclerosis and the modifying effects of the overlying enamel.

牙釉质比牙本质透明。这种现象在那些有透明切嵴的年轻人口中常常很明显。复杂的是表层釉质的厚度并不是一成不变的。随着患者年龄的增长，透明层随着牙体的磨耗和切端的磨短而丧失。这会引起一系列的后果，例如，一个典型的表现是同一牙齿的唇面常呈现不同的颜色。一颗牙齿不可能只有一种颜色，例如，A2色的牙齿靠近切端的颜色是浅蓝色的，而龈缘则是较深的红色。切缘透明常表明牙本质的相对缺失，而龈缘处则常有

Enamel is more translucent than dentine. This is often very apparent in young people who frequently have translucent incisal edges. To complicate matters further the overlying enamel has variable thickness. As the patient ages this translucency is lost as the tooth wears and the incisal tip reduces. This has various consequences. For example, over the labial face of a tooth different shades are typically present. A tooth is unlikely to be a single shade—for example, towards the incisal tip the colour

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一些牙周组织的反射光存在。

比　色

为帮助牙冠和天然牙配色，大多数生产瓷粉和复合树脂的厂家都生产了比色板。最常使用的比色板是Vita经典比色板（VITA Zahnfabrik H.Rauter GmbH & Co.KG，D-79713 Bad Säckingen,Germany），它已得到广泛的认可（图2-2）。虽然很多产商已生产了一些设计更完善的比色板，但似乎无一能够取代Vita经典比色板的地位。这种比色板分为红棕色（A）、红黄色（B）、灰色（C）和红灰色（D）。A、B色标代表两种主要的色相。C和D色标分别代表明度较低的B和A色标。大多数情况下，这种比色板提供的色谱选择宽度足以匹配大多数人的牙齿。

of A2 is a lighter blue while at the gingival margin a darker red. The incisal translucency frequently represents the relative absence of dentine, while at the gingival margin there will be some reflection of the periodontal tissues.

Shade-Matching

To help match crowns to natural teeth most manufacturers of porcelains and resin composites produce shade guides. The most commonly used guide is the Vita Classic shade guide (VITA Zahnfabrik H. Rauter GmbH & Co.KG, D-79713 Bad Säckingen, Germany), which has almost universal acceptance (Fig 2-2). Many manufacturers have produced betterdesigned guides, but nothing seems to have replaced the original Vita Classic shade guide. The guide is divided into reddish brown (A), reddish yellow (B), grey (C) and reddish grey (D) shades. There are two main hues in the A and B shade guide tabs. The C and D tabs represent lower values of B and A tabs, respectively. In most circumstances the



图 2-2　Vita 经典比色板

Fig 2-2　Vita Classic shade guide.

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shade guide provides a sufficiently wide spectrum of choice to map most people's teeth.

临床医师在使用 Vita 经典比色板时应首先考虑色相。例如，患者的牙齿颜色和 A 色匹配，然后使用 Vita 经典比色板，从 A1，A2，A3，A3.5 或 A4 中进行选择。相反，新的 Vita 三维大比色板将相同明度，但色相不同的色标集中放在一起，临床医师要首先考虑明度，再考虑色度，在这个问题上应优先考虑哪个还存在争议（图 2-3）。比较精确的方法是由技工室的技师专门为临床医师定做每颗牙的比色板。

The Vita Classic shade guide makes the operator think about hue. For example, the patient's teeth are matched to an A hue and then, using the Vita Classic shade guide, the shade is selected from A1, A2, A3, A3.5 or A4. In contrast, the new Vita 3D master shade guide, which clusters hues of similar value, makes the operator think about value first and chroma second and is arguably superior in this respect (Fig 2-3). A more accurate method might include the laboratory providing a custom-made shade guide for each tooth made by the technician supporting the practitioner.

正确比色的技巧

- 在为修复体正确比色时，颜色并不是最重要的因素，也不是首先要考虑的问题。

Tips for Choosing the Right Shade

- Colour is NOT the most important factor when selecting the correct shade for a restoration, and it should not be the

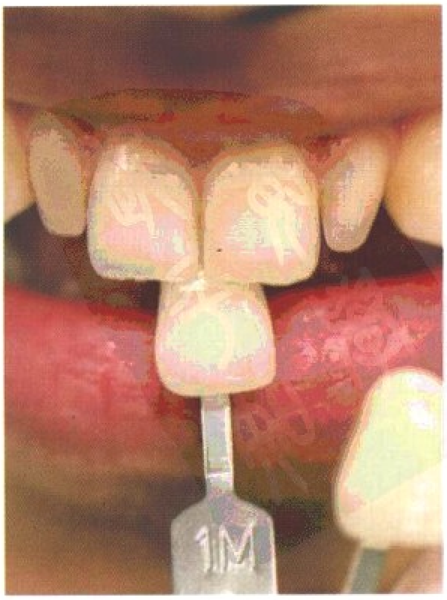


图 2-3　三维大比色板

Fig 2-3　Master shade guide in 3D.

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• 观察患者的肤色。
• 首先观察邻牙。
• 考虑牙齿的表面解剖，注意形状、外形、纹理和轮廓。眼睛对形状比对色相更敏感，因此，一开始就要确定形状、纹理及轮廓，这一点很重要。有争议的是，一个形状和外形正确而比色不当的修复体可以将就，而比色正确、外形难看的修复体则令人难以接受。

• 在设计单上画图来帮助技师，画图应包括表面特征如裂纹、表面着色、白斑区以及其他一些你希望表述的表面特征（图2-4）。牙齿的表面纹理对比色有重要的影响，因此，金属烤瓷冠的试戴对最终的外观评价并无太大帮助。

first consideration.

• Look at the patient's skin tone.
• Look initially at the adjacent teeth.
• Consider the surface anatomy, concentrating on shape, form, texture and contour. The eye perceives shape before shade, so it is important to get the shape, texture and contour right at the start. Arguably, a restoration that is correctly shaped and formed but a shade out will pass, while a correctly shaded but poorly contoured restoration will not.
• Draw a diagram on the laboratory sheet to assist the technician. Include surface characteristics such as cracks, surface-staining, areas of opalescence and other surface topography you wish to include (Fig 2-4). The texture of the surface of the tooth can have a profound effect on the perceived shade,

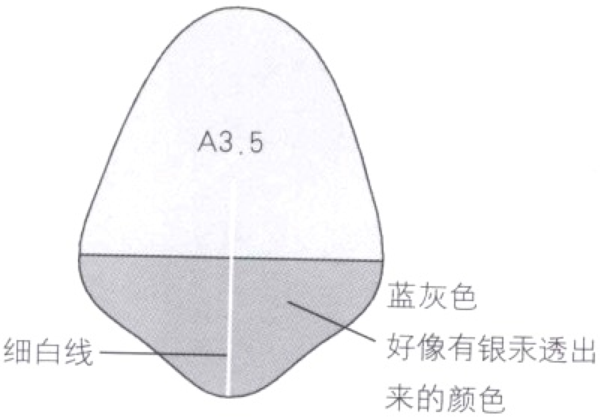


图 2-4 设计单

Fig 2-4 Laboratory prescription.



图 2-5 按明度排列的 Vita 经典比色板

Fig 2-5 Vita Classic shade guide arranged according to value.

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and for this reason a biscuit bake try-in of a metal ceramic crown is not very helpful for assessing its final appearance.

- 不要忘记在设计单上注明患者的年龄和性别，因为这些信息对技师很有帮助。
- 彩色照片有助于将牙齿表面特征传递到技工室，某种程度上还有助于评估比色是否正确。虽然很多临床医师会利用彩色照片，但黑白照片同样也很有用，特别是对一些困难病例，在良好的光照条件下拍摄的黑白照片对帮助技师正确评估牙齿的明度特别有用。
- 为了对牙齿进行比色，将比色板按明度从亮到暗的顺序排列是很有帮助的，即从 B1 到 C4（图 2-5）。另外，也可首先选择色相，然后再考虑色度。例如，色相可能是A，然后选择是A1，A2，A3，A3.5 还是 A4。
- 通常情况下，年龄越大的患者牙色越暗。因此，为一位50岁的患

- Remember to include the age and gender of the patient on the laboratory prescription form, as this information is very helpful for the technician.
- Colour photographs are useful for communicating the surface characteristics of the tooth to the laboratory and, to a certain degree, with shade assessment. Although many practitioners will have the facilities for colour photography, black-and-white photography can also be very useful, in particular in difficult cases. Black-and-white photographs are particularly helpful in assisting the technician to assess the correct value, provided the photograph is taken under good lighting conditions.
- To assess the shade of the tooth it is helpful to arrange the shade guide according to value running from the lightest to the darkest — say, from B1 to C4 (Fig 2-5). Alternatively, first choose the hue and then the chroma. For example, the hue may be A and then the choice is A1, A2, A3, A3.5 or A4.
- In general, the older the patient the darker the tooth. Consequently be

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者选择很亮的颜色，如A1，要慎重；成年人牙齿的色度一般是3或3.5。

wary of choosing very light shades, such as A1, for a 50-year-old; generally the teeth of mature adults have a chroma of 3 or 3.5.

- 患者有一种选择颜色较浅牙齿和倾向，许多人选择A1和A2。这一点也不奇怪，因为大量的患者已尝试过某种形式的牙漂白，并且患者自己还要求把牙齿做得亮一些。

- There is trend toward lighter shades, with many A1 and A2 being selected. This is almost certainly as a consequence of large numbers of patients having had some form of dental bleaching coupled with patient requests for lighter teeth.

- 比色时应一直让患者站着或者坐着，而不应躺着。因为，比色的光照条件应与修复体最终被看到时的条件完全相同才合理。如果比色时患者采取卧姿，光照条件则完全不同，这必然会影响比色结果以及修复体的美学效果。

- Always take the shade with the patient either sitting or standing, never supine. This is because it is sensible to assess shade under similar conditions, in terms of lighting, as the restoration will ultimately be viewed. If a shade is taken with the patient in a supine position, the lighting conditions are completely different. This will affect both shade determination and in turn the aesthetic acceptability of the restoration.

- 以一臂长的距离握住比色板，靠近牙面。将比色板在牙齿间移动，注意不要凝视太久。隔一段时间就嘱患者用唾液湿润一下牙齿。

- Hold the guide at arm's length, adjacent to the tooth surface. Move the guide from tooth to tooth taking care not to stare too long. Periodically ask the patient to moisten the teeth with saliva.

- 快速扫视一眼牙齿。凝视牙齿，然后将视线移开。这样做可以减小因临床医师视杆细胞和视锥细胞疲劳而产生的影响。

- Take short sharp glimpses at the teeth. Glance at the teeth then look away. This is to minimise the effects of fatigue of rods and cones in the oper-

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• 注意加强比较，因为背景会影响比色。例如，同一颜色在白色和黑色的背景上看起来会不同（图2-6）。为了帮助比色，应将色标放在要比色牙齿的同一垂直平面上，让患者将舌头前伸，给比色创造一个统一的且有意义（组织色）的背景。

• 光在比色中起着重要的作用，应记住颜色是可用光的主要功能之一。选色时试着使用不太亮的自然光。非常亮的日光可能会导致所选的颜色过亮。如果诊室有窗户，最好让患者站在窗户边比色。

• 如果无法利用自然光，可使用自

ator's eyes.

• Be aware of contrast enhancement, given that the background can have an effect on the perceived shade. For example, a shade will look different on white and black backgrounds (Fig 2-6). To assist in shade-taking, always have the tab in the same vertical plane as the tooth you are matching and ask the patient to posture their tongue forward to give a consistent and meaningful (tissue-coloured) background against which to take the shade.

• Light plays a critical role in assessing colour, remembering that colour is primarily a function of the available light. Try and use natural daylight that is not too bright when selecting a shade. Very bright natural daylight may result in the selection of too light a shade. If the surgery has a window, it is helpful to have the patient stand by the window when taking a shade.

• If natural light is not possible, use a

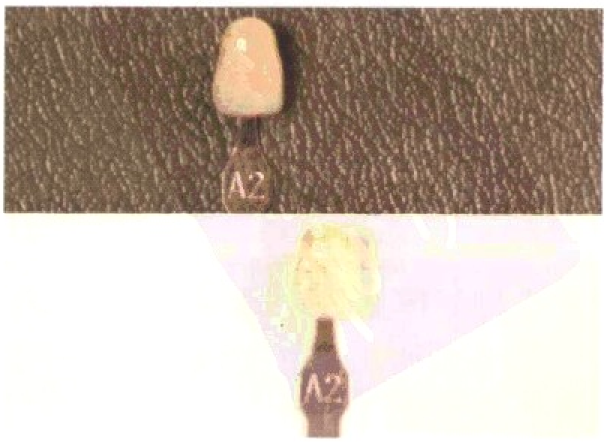


图2-6　背景对比色的影响。这些比色实际上是相同的，但其中一个看起来较暗

Fig 2-6　The effect of background on shade perception. These shades are actually the same but one appears darker.

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然光色的灯光。另外，要确保诊室内的荧光灯颜色正确。理想情况是，你使用的光源应该与技工室的技师制作修复体时使用的光源相同。因此，应确保技工室使用同样颜色的灯管。但是，使用颜色正确的灯管仅仅解决了问题的一个部分，因为灯管在某种程度上也是不一样的。

natural light lamp. Alternatively, make sure the fluorescent lights in the surgery are colour- corrected. Ideally, the lighting source you use should be the same as the one the technician uses in the laboratory to produce the restoration. It is sensible, therefore, to ascertain that your laboratory has the same colour-corrected tubes. Colour-corrected tubes, however, are only part of the answer as they can be somewhat variable.

- 应减小变位异构作用。所谓变位异构作用，就是某一物体，如牙齿，在不同光照条件下显现出不同颜色的现象。因此，应在至少两种不同光照条件下比色，如在诊室以及日光下比色，或者，无日光可用时，可在较暗以及较亮的诊室的光照条件下比色。

- The effects of metamarism, which occurs when the colour of an object—a tooth, for example—appears different in different lighting conditions, should be minimised. To do this, try and assess the shade in at least two different lighting conditions. For example, assess the shade in both surgery and daylight or, if daylight is not available, try assessing the shade in dimmed and bright surgery lighting conditions.

- 你的第一选择往往是正确的。经验表明比色时间越长，比色可能越不正确。

- Your first decision is normally correct. Experience suggests that the longer it takes to assess the shade the more likely it is that the shade is incorrect.

- 如果患者的颜色在C或D的范围之内，应再检查一次。这些颜色是天然牙中相当少见。

- If a patient has a shade in the C or D ranges check again. They are relatively uncommon shades in natural teeth.

- 询问护士的意见会有所帮助，在做最终决定之前询问患者的意见是明智的作法。

- It is helpful to ask your nurse's opinion and wise to include the patient in the final decision.

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- 另一个方法就是让技师参与比色。

- Another option is to involve the technician in shade selection.

视杆细胞和视锥细胞

最近计算机技术在临床牙科方面已经取得了长足的进步。虽然计算机最早引入牙科诊室只是用于数据传输，但数字化革命拓展了计算机的应用范围，其中之一就是用数字图像比色并进行颜色传输。

许多计算机比色系统，如图2-7中列举的，在照明控制方面有优势，据报道，这种方法能产生更一致的结果。市场上有好几种比色系统，有一些是用于比基本色的，而其他的则是提供多彩图谱和（或）透明图谱的（图2-8和图2-9）。前面介绍过的一个系统在临床和实验室均有应用。牙齿的一个数码图像以及灰度标准都是在两种光照条件（自然修正光及偏振光）下获得的。使用相关软件对这些图像进行分析，并传输到技工室，建议将所比的颜色

Pixels v. Rods and Cones

Recently computer technology has made significant progress into clinical dentistry. Although computers were introduced into dental surgeries primarily for data–transmission, the digital revolution has seen many further applications, one of which has been the use of digital images for shade-taking and colour communication.

Computer-based shade-taking systems, an example of which is illustrated in Fig 2-7, are thought to have the advantages of controlled illumination, which is reported to produce more consistent results. There are several systems on the market, some of which are useful for taking base shades, while others provide polychromatic and/or translucency maps (Figs 2-8 and 2-9). One system that has been introduced has clinical and laboratory applications. A digital image of the teeth and a grey standard is

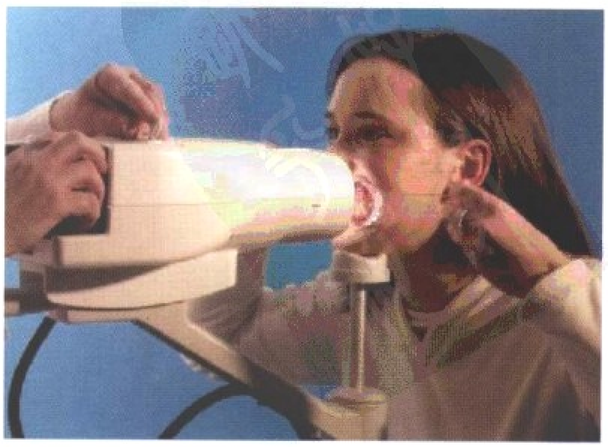


图 2-7 Ikam™ 数码比色系统

Fig 2-7 Ikam™ digital shade taking system.

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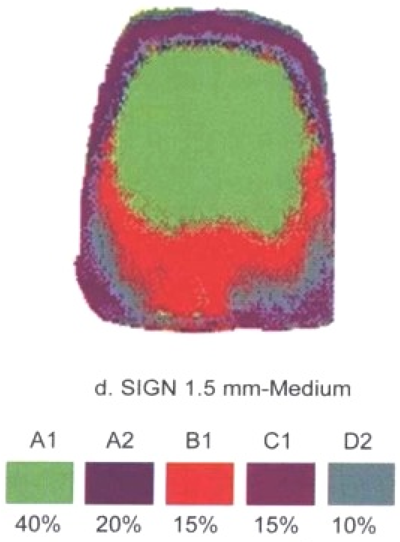


图 2-8 多彩图

Fig 2-8 Polychromatic map.

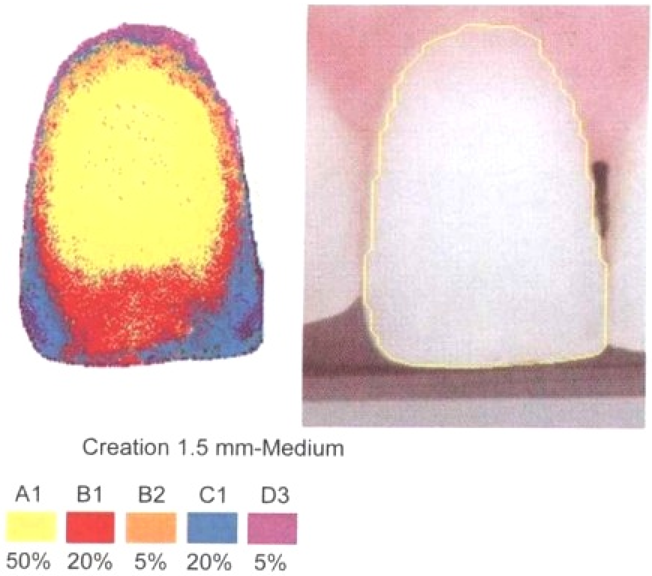


图 2-9 数码分析

Fig 2-9 Digital analysis.

画在一张彩色的设计单上，技师可根据它制作间接修复体。技工室有一部与临床相似的装置。在修复体送回临床之前，可以进行图像处理和颜色分析，以确保它与原先设计单上的颜色一致。这些系统在推荐到临床作为常规使用之前，还需要进一步的研究来进行评估。总而言之，如果你有数码比色系统，最好按照以下步骤进行：

- 用眼睛比一个色。

taken under two lighting conditions — natural colour-corrected light and polarised light. These images are analysed by the associated software and transmitted to the laboratory, where suggested shades are shown on a polychromatic prescription which the technician uses to build up the indirect restoration. The laboratory has a set-up similar to that used in the clinic. The restoration can be imaged and the shade analysed to ensure it matches the original prescription before it is returned to the clinician. Further research is needed to evaluate these systems before they can be recommended for routine use. The general consensus is that it is best to proceed as follows if you have a digital shadetaking system:

- Take a visual shade.

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- 用计算机进行一个数码比色，并将两者进行比较。如果结果一致，你的比色很可能是正确。
- 将这个比色结果连同数码图像，包括两个最接近的色标一起送到技工室。
- 记住无论技术设备多好，结果最终还是要依靠技师的技术，以及足够的备牙空间来完成一个美观满意的修复体。

- Take a computerised digital shade and compare. If they agree you probably have the correct shade.
- Send this shade to the laboratory along with a digital image, including the two closest matching shade tabs.
- Remember that no matter how good the technology, the result is still dependent on the skill of the technician and having sufficient space in which to develop an aesthetically pleasing restoration.

拓展阅读
Further Reading

Aoshima H. A Collection of Ceramic Works: A Communication Tool for the Dental Office and Laboratory. Berlin:Quintessenz Verlag, 1993

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第 3 章 漂白与微打磨

Bleaching and Microabrasion

目　的

漂白术是提高活髓牙和死髓牙亮度且破坏性最小的一种方法。微打磨对于去除前牙局部釉质着色很有效（常作为辅助措施）。对于经过仔细筛选的病例，微打磨术可与活髓漂白术联合使用以提高前牙美观效果。本章的目的是讨论各种死髓和活髓漂白术，以及微打磨术。

Aim

Bleaching is a minimally interventionist means of improving the brightness of vital and non-vital teeth. Microabrasion is a useful (often adjunctive) technique for removing localised enamel discoloration from anterior teeth. In carefully selected cases microabrasion can be usefully combined with vital bleaching procedures to improve anterior aesthetics. The aim of this chapter is to consider different non-vital and vital bleaching procedures along with the technique of microabrasion.

要　点

从业医师要熟悉各种死髓牙和活髓牙漂白术的优点、缺点、适应证及禁忌证。同样，从业医师也一定要熟悉微打磨技术。

Outcome

Practitioners will be familiar with the advantages, disadvantages, indications and contraindications for various methods of bleaching vital and non-vital teeth. Equally, practitioners will be familiar with the technique of microabrasion.

引　言

牙齿的颜色是非常主观的，不同

Introduction

The colour of teeth is very subjective. It

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的人有不同的认识。例如，患者可能认为他们的牙齿太暗，然而从业医师却认为在正常的颜色范围内。这种现象通常发生在尖牙，患者总是错误地认为它的颜色和切牙的颜色不匹配。尖牙比切牙的颜色暗，但这只是由于尖牙的颊舌径比切牙的厚而产生的正常结果。在患者漂白前签署知情同意书时，一定要重点考虑医生和患者在牙齿颜色判断上的差异问题，因为我们无法保证漂白术一定会成功，更不能保证漂白的效果会持续多长时间。

means different things to different people. For example, a patient may be convinced that their teeth are too dark and yet to the practitioner they appear to be within the normal colour range. This commonly occurs with canines, which are wrongly described by patients as being a mismatch in colour with their anterior teeth. Canines are darker than incisors, but this is the natural result of the canine being thicker–buccolingually than the other anterior teeth. Differences in the assessment of the colour of teeth between patient and clinician can be an important consideration when obtaining informed consent for bleaching procedures, as it is not possible to guarantee that the technique will be successful, let alone how long the bleaching effect will last.

牙体变色的常见原因

牙体变色的原因可以分为以下几种：

局部着色

外伤

- 恒牙
- 发育中的牙

表面着色

- 外源性着色——饮食、吸烟或菌斑相关性着色

Common Causes of Tooth Discoloration

The causes of tooth discoloration can be classified as follows:

Localised

Trauma:

- permanent teeth
- developing teeth.

Superficial staining:

- extrinsic causes–dietary, smoking or plaque-related

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- 龋病
- 修复体变色

- caries
- discoloured restoration.

广泛着色

获得性着色

- 增龄性改变
- 四环素牙
- 氟斑牙

Generalised

Acquired:

- age-related
- tetracycline
- fluorosis.

遗传性着色

- 釉质发育不全
- 牙本质发育不全

显然，导致牙体变色的原因很多，诊断非常重要，因为它决定了患者的治疗方案。

Hereditary:

- amelogenesis imperfecta
- dentinogenesis imperfecta.

It is clear that there are a number of causes for tooth discolouration and the diagnosis is important, as this will determine how an individual case is managed.

外 伤

发育完好的牙齿若血供系统遭到破坏就会丧失活力。有时牙髓组织的急性变性会导致髓牙坏死。牙髓变性后血色素沉着，其中血红蛋白会渗透至牙本质小管中，分解后导致牙齿严重变色。着色的程度可以有很大差异，从很深的颜色到轻微到几乎无法察觉的着色都有。着色的程度一般决定了漂白所需要的时间，对于某些病例，还决定了漂白成功的概率。

Trauma

Damage to the blood supply of fully developed teeth may result in the loss of vitality. The pulpal tissues degenerate, sometimes acutely, producing a non-vital tooth. The blood pigments left behind following pulp degeneration include haemoglobin, which infiltrates the dentinal tubules, leading to significant tooth discoloration when this breaks down. This stain can vary in intensity from very dark to almost imperceptible. The intensity of the discoloration will in general determine the time needed to bleach the tooth and in some cases the likelihood of success.

少数情况下，乳牙的外伤会损坏

Infrequently, trauma to a deciduous tooth

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发育中的替换恒牙，结果可能导致恒牙颜色或外形上的改变。如果着色不深，可以纠正；如伴有恒牙外形的改变，则必须成年后再接受贴面或冠修复的治疗了。

will damage the developing permanent replacement. The result might be a change in colour and shape of the permanent tooth. The discoloration, provided it is not too intense, may be corrected. The change in shape may necessitate the provision of a veneer or crown in adult life.

表面着色

彻底的洁治和抛光可以去除牙体表面的外源性着色。一般的食物添加剂，如鞣酸，可以使暴露于其中的牙体表面着色加重。吸烟同样会导致牙体大面积外源性着色，尤其是重度吸烟者。这种着色尽管是外表面的着色，但常规的洁牙和抛光术却很难去除。含有乳化剂和二氧化钛的美白牙膏可以去除表面的着色，而且似乎可以使牙齿变白。这些可以用于去除食物着色、烟斑以及漂白后的牙齿颜色的维持。

Superficial staining

Superficial extrinsic staining can be removed by a thorough scaling and polishing. Common dietary supplements — for example, tannin — will cause a superficial stain to develop on the exposed surfaces of teeth. Smoking can also cause extensive extrinsic staining of teeth — in particular, in heavy smokers. Such stains, although superficial, can be quite resistant to routine cleaning and polishing techniques. Whitening toothpastes, containing emulsifiers and titanium dioxide, may remove superficial stain and appear to whiten the teeth. They are particularly useful for removing dietary stains, tobacco tars and for shade maintenance after bleaching.

有时，口腔卫生不良患者的龈沟被产色素型细菌占领，这会引起龈沟边缘变黑/绿。典型的表现是，常规的预防性洁治对于去除此种外部着色无效，必须漂白或去除部分牙体。

Occasionally, a chromogenic-type bacterium colonises the gingival crevice of patients with poor oral hygiene. This causes a green/black stain along the cervical margin of the teeth. Typically, a routine prophylaxis fails to remove such surface stain and either bleaching or tooth reduction is required.

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增龄性改变

随着年龄的增长，人的牙齿颜色会逐渐变暗或是看起来越来越暗，原因可能是釉质磨损导致其下层颜色较深的牙本质暴露所致，或是由于增龄性牙本质钙化导致牙体外观变黑所致。牙齿颜色的变化需与年龄相适应，因为真正的老年性变色不会特别明显。同样，牙齿的颜色需看起来自然，一张老年人的脸上配上过白的牙齿会显得很不自然。

Age-related changes

As people age their teeth darken or appear darker. This may be a result of the enamel wearing, exposing the underlying darker dentine, and/or the effect of age-related sclerosis of dentine: consequently the tooth appears darker. This apparent change must be balanced against the patient's age, as the actual colour change with age might not be so prominent. Equally the tooth colour may appear to be natural while lighter teeth would appear unnatural when framed by an older face.

四环素牙

现在认为，给牙齿仍在发育中的非严重感染的患者开四环素是不可原谅的错误。因而，四环素着色牙的发病率正逐年下降，尤其是在英国。这和其他一些发展中国家形成了鲜明的对照。四环素分子被整合入发育中的牙体组织，改变牙本质的颜色，而牙体的颜色是由牙本质的颜色所决定的（图3-1）。牙齿从黄到蓝灰色的着色程度取决于患者服用的四环素的性质和浓度，以及含四环素的牙体组织在萌出后暴露于紫外线中时间的长短。某些棕黄色的四环素着色，用活髓漂白术很容易去除。而蓝灰色的四环素着色通常漂白效果不佳。

Tetracycline

Prescribing tetracycline for non-critical infections in patients with developing teeth is now considered to be indefensible. Consequently, the incidence of tetracycline discoloration is decreasing, notably in the UK. This is in contrast to other parts of the developing world. The tetracycline molecule becomes incorporated into developing tooth tissues, changing the colour of dentine from which teeth get their inherent colour (Fig 3-1). The degree of yellow to bluegrey discoloration depends on the nature and concentration of tetracycline administered to the patient and the exposure of the tetracycline-containing tooth tissues to ultraviolet light following eruption. Some brown/yellow tetracycline stains are

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图 3-1 四环素着色
Fig 3-1 Tetracycline staining.

relatively easy to overcome using vital bleaching techniques. Blue-grey tetracycline stains often remain resistant to bleaching.

氟斑牙

氟斑牙是指在牙冠发育期间摄入过量的氟而导致牙体产生棕色和白色斑点。饮用水中氟含量若超过 1 ppm，就会增加氟斑牙的危险，特别是同时摄入大量的牙膏或其他含氟食品。

Fluorosis

The intake of excessive amounts of fluoride during tooth crown formation may result in brown and white speckled mottling of the tooth–fluorosis. Concentrations of more than 1ppm of fluoride in drinking water increase the risk of fluorosis–in particular if large amounts of toothpaste or other dietary supplements of fluoride are taken at the same time.

用牙漂白或微打磨法去除表面的釉质可减少棕色斑点，而周围的白色不透光斑点则较难去除，但是这些斑点对活髓漂白术的反应一般都很好。这些没什么破坏性的治疗方法通常优于冠或贴面，因为无需牺牲牙体组织。

Bleaching or removing the superficial layer of enamel with microabrasion normally eliminates brown mottling. The surrounding white speckled opacity is more difficult to remove but usually responds favourably to vital bleaching. These less interventive management techniques are usually preferred to crowns or veneers, since no tooth tissue needs to be sacrificed.

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遗传性因素

牙本质发育不全和牙釉质发育不全相当少见。临床上较难区别这二种情况。牙本质发育不全(遗传性乳光牙本质)的特点是鳞茎状根的形成和根管的缺如。X线检查对牙本质发育不全的确诊极有价值，牙釉质发育不全则更难诊断，因为其表现多种多样。人们常常将牙本质发育不全与严重的氟斑牙混淆。

Hereditary causes

Dentinogenesis imperfecta and amelogenesis imperfecta are relatively rare conditions. It can be difficult to differentiate these conditions clinically. Dentinogenesis imperfecta (hereditary opalescent dentine) is characterized by bulbous root formation and an absence of root canals. Radiographs are invaluable in confirming a diagnosis of dentinogenesis imperfecta. Amelogenesis imperfecta is more difficult to diagnose, as the condition has a variable presentation. Confusing amelogenesis imperfecta with marked fluorosis is not unusual.

活髓漂白术

过氧化氢 (H_2O_2)

用过氧化氢来漂白牙齿已沿用了一个世纪。牙齿漂白（变浅或变亮）对于着色或变色的健康牙来说，是一种有效的治疗手段。活髓漂白术具有另一个优点，既没什么破坏性又可保存牙体组织。其他的治疗，如贴面、全瓷冠和金属烤瓷冠，都必须要去除相当多的牙体组织。和大多数临床治疗方法一样，活髓漂白术也不是毫无风险的，只不过风险很小。为了降低冠修复后牙髓失活的风险，漂白术成为改善变色牙外观的首选治疗方案。尽管贴面和冠修复可以改善着色牙的外观，但它们可能永远也不能重现完好牙的

Vital Bleaching

Hydrogen Peroxide (H_2O_2)

Hydrogen peroxide has been used to bleach teeth for over a century. Bleaching (lightening or brightening) teeth is an effective treatment for stained and discoloured sound teeth. Vital tooth-bleaching has the added advantages of being both less interventive and conservative of tooth tissues. Alternative treatments, such as veneers, all-ceramic crowns and metal-ceramic crowns, by necessity require extensive tooth-tissue removal. Vital tooth-bleaching, in common with most clinical procedures, is not without some risk. This risk is, however, low. Balanced against the

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透明度和活力。

risk of a tooth becoming nonvital after crowning, bleaching remains the initial treatment of choice to improve the appearance of discoloured teeth. Although veneers and crowns can improve the appearance of discoloured teeth, they can never reproduce the translucency and vibrancy of the intact tooth.

作用机制

过氧化氢是一种微小的分子，因此它可以渗透至釉质和牙本质中，产生漂白的作用。过氧化氢以及某些可降解为过氧化氢的产品，离解后形成过氧化物离子和水。这种高活性的过氧化物离子，是漂白中的有效成分。这些活性离子通过氧化釉质及牙本质中的色素去除着色。大多数临床的漂白技术都基于此原理，但通过延长接触时间、使用较高浓度的过氧化氢，或者像从前那样给漂白剂加热等方法可以提高漂白速度。

Mode of action

Hydrogen peroxide is a minute molecule. As a consequence, it is able to penetrate enamel and dentine, effecting a change that results in bleaching. Hydrogen peroxide, or those products that degrade to produce it, dissociates to form the superoxide ion and water. It is the high reactivity of the superoxide ion which is thought to be responsible for the bleaching process. The reactive ion removes the stains from teeth by oxidising pigments trapped in the structures of enamel and dentine. Most clinical techniques for bleaching rely on this effect but vary the speed by either extending the periods of contact, using higher concentrations or, as previously practised, heating the bleaching agent.

过氧化脲

过氧化脲，又称过氧化尿素，分解后形成过氧化氢和尿素，在口腔环境中过氧化氢形成过氧化物离子和水，而尿素形成氨和二氧化碳。尿素作为

Carbamide Peroxide

Carbamide peroxide, otherwise known as urea peroxide, breaks down to form hydrogen peroxide and urea. In the oral environment the hydrogen peroxide forms the su-

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降解产物的一部分，产生的量很少，所以不会产生任何的生物学作用。大多数关于过氧化脲的安全性和高效性的研究表明，10%的浓度比较适宜。但最近，高浓度的产品已经问世，它可以提高反应速度，加快漂白进程。浓度为10%的过氧化脲溶解时，产生3.35%的过氧化氢，15%的过氧化脲溶液可产生5%的过氧化氢，而35%的过氧化脲（椅旁漂白）则可产生10%的过氧化氢。为了避免产生副作用，在使用过氧化脲溶液和凝胶时，务必根据产品说明书小心使用。

peroxide ion and water, while the urea forms ammonia and carbon dioxide. The amount of urea formed as part of the breakdown is too small to have any biological consequence. Most research on the safety and efficacy of carbamide peroxide has been on a 10% concentration. More recently, higher concentrations have been produced that increase the speed of reaction and so the bleaching process. A 10% solution of carbamide peroxide produces 3.35% hydrogen peroxide, a 15% solution of carbamide peroxide produces 5% hydrogen peroxide and a 35% carbamide peroxide (chair-side bleaching) gives 10% hydrogen peroxide. To avoid any adverse reactions care must be taken to use solutions and gels of carbamide peroxide according to manufacturer's directions.

安全性

以前，漂白术只用于提高死髓牙的亮度，仅在过去15年左右的时间里，活髓漂白术才开始普及起来。任何临床操作都存在相应的风险，使用过氧化氢漂白牙齿也不例外。在早期，因为使用了加热的方法来激活过氧化氢，使该技术具有相当高的后期牙吸收的风险。最近，漂白术对全身的潜在性影响已经越来越受到关注，但至今尚无任何科学的证据。主要观点是过氧化氢具有产生细胞损伤的潜在威胁。大多数调查这一作用的研究都使用了动

Safety

In the past, bleaching has been used to lighten non-vital teeth. Only in the past 15 years or so has the bleaching of vital teeth become more common. There are risks associated with any operative procedure: using hydrogen peroxide to bleach teeth is no exception. In the early days the technique carried a relatively high risk of subsequent resorption because heat was used to activate the hydrogen peroxide. More recently, the potential for systemic effects has raised concerns, none of which has, to date, found

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物模型，用提高单位体重的药物浓度并延长作用时间的方法来做实验，但很难推测这种情况下过氧化氢对临床的作用效果。过氧化氢是人体酶作用的副产物，它能被酶自然降解，从而减小其潜在的危害作用。尽管从动物研究中得出的结果表明过氧化氢对小型哺乳动物有毒性作用，但是对人体的风险似乎很小。研究调查一致认为：过氧化氢或其他相关产物对漂白活髓或死髓牙产生损伤的副作用很小。基本上，漂白术的优点远远超出了其理论上的风险。

any scientific support. The main concern with hydrogen peroxide is its potential to cause cellular damage. Most of the studies undertaken to investigate this effect have used animal models, with high concentrations per body weight applied for extended periods of time. It is difficult to extrapolate the effects of hydrogen peroxide under such situations to the clinical situation. Hydrogen peroxide is a by-product of human enzymatic action, which is then naturally degraded by enzymes to reduce its potentially damaging effect. Despite the results from animal studies suggesting toxic effects on small mammals, the likely risk to human beings is very low. The consensus of opinion based on research is that the risk of damaging side-effects from hydrogen peroxide or other associated products used to bleach vital or non-vital teeth is small. In essence, the benefits of the treatment far outweigh the theoretical risks of the procedure.

对牙及修复材料的作用

实验研究结果表明漂白对牙体组织无副作用，对漂白后的釉质硬度以及釉质与复合树脂的粘结强度的研究，都未发现漂白剂对临床有任何影响。也没有关于漂白对牙本质粘结力影响的研究，因为漂白剂对牙釉质的影响都是微不足道的。

Effects on Teeth and Restorative Materials

Findings from laboratory studies suggest that bleaching has no adverse effect on tooth tissues. Studies on enamel hardness and the bond strength of resin composites to bleached enamel have failed to demonstrate any clinically significant effects of bleaching. There is less research available

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on the effects of bleaching on dentine bonding but the effect, as with enamel, would appear to be negligible.

在修复漂白过的牙齿时，一般建议延迟使用复合树脂或玻璃离子粘固剂至漂白完成至少 24 h 以后。漂白的影响之一是牙表面脱水，尽管再水化通常很快（不到 24 h），但是在着手进行牙色材料修复之前，给足够的时间使牙面再水化是明智之举。另一种方法，就是在漂白进行之前就完成修复治疗，其缺点是新粘固的修复体表面暴露在过氧化氢中，难以预测漂白后牙齿颜色的改变，通常临床漂白结束后，患者会要求更换修复体以匹配漂白后牙体的新颜色。因此，有必要提醒患者漂白后可能需要重新更换前牙修复体。

When restoring bleached teeth it is generally recommended to delay the provision of restorations of resin composites or glass ionomer cements for at least 24 hours following completion of bleaching. One of the effects of bleaching is dehydration of the tooth surface. Although rehydration tends to occur quickly (<24 hours), it is advisable to be satisfied that sufficient time has elapsed before proceeding to provide tooth-coloured restorations. An alternative approach is to place restorations before bleaching, but this has the disadvantage of exposing the surfaces of recently placed restorations to hydrogen peroxide. Furthermore, it is difficult to predict shade following bleaching. A common clinical outcome of bleaching is patients requesting restorations be changed to match the new colour of the teeth. It is helpful, therefore, to warn the patients that anterior restorations may need to be replaced following bleaching.

如果在漂白以后进行冠修复，那么邻牙会逐渐向它们漂白前的颜色反复，使修复的冠看起来过亮。对不需要怎么预备的牙体用透明瓷修复，如树脂粘结冠或贴面，它们对漂白的反应略有不同。漂白剂可能通过牙体与修复体之间的界面透入，作用于下方牙

If new crowns are placed after bleaching the adjacent teeth may gradually revert to their original pre-bleached colour and the crowns will appear too bright. Minimally prepared teeth restored with restorations of translucent porcelain—for example, resin-bonded crowns or laminate veneers—may

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本质上，牙本质的颜色随之反过来影响修复体的颜色。如果漂白后进行冠修复或贴面修复的话，那么包在其内的牙体在一段时间后变黑的可能性更大，从而导致修复后的牙齿变黑。以往贴面修复的临床经验表明，贴面修复牙变黑可以通过一个设计适当的漂白牙托，从牙齿的腭面重新漂白予以纠正。如果在漂白后进行的是全冠修复，应谨慎选用内冠系统，以保护修复体不受其下方的牙本质变色的影响。

have a slightly different response to bleaching. The bleaching material may pass through the marginal interface to affect the colour of the underlying dentine, which will, in turn, affect the colour of the restored unit. More likely, if bleached teeth are subsequently crowned or veneered, the core of the tooth may darken over time, resulting in a darkening of the restored tooth. Previous clinical experience with veneers has shown that darkening a veneered tooth can be corrected by rebleaching via the palatal surface, with an appropriately designed bleaching splint. If full-coverage crowns are prescribed post-bleaching it is prudent to use a system that has some form of coping to protect the restoration from changes in the colour of the underlying dentine.

漂白材料对银汞合金的影响也有研究。漂白剂的应用一般不会导致汞释放量的显著增加，且汞释放量都在许可的安全范围内。少数情况下，银汞修复体的外观会由暗色变成银白色。

The effects of bleaching materials on amalgams have also been investigated. It is unlikely that the bleaching agents used will result in the release of significant levels of mercury, and any mercury released is within recognized safety limits. Occasionally, amalgam restorations may change from a dark to a more silver appearance.

漂白的稳定性

活髓牙对漂白的反应是不一样的，有些牙漂白后维持颜色长达数十年，这种情况并不少见，但有些病例的漂白效果维持时间较短。对多数患者来

Stability of Bleaching

The response of vital teeth to bleaching is variable. It is not unknown for bleached teeth to remain whitened for decades. In other cases the effects may be short-lived.

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说，初次漂白后牙齿的颜色可保持稳定达2~3年，此后，则可能需要强化漂白一次。如果这种变化发生太快，在几个月之内的话，则需要换用另一种漂白技术或者修复方法。在考虑漂白效果的不稳定问题时应该与其他不可逆的、破坏性更大的修复技术相权衡，通常其他许多修复技术也同样存在一定的使用寿命。无论如何，在开始治疗之前，都应该提醒患者可能存在的风险。

In most patients the colour of their bleached teeth will remain stable for periods of up to two to three years after which "top-up" bleaching may be required. If the change occurs more quickly, within months, then another bleaching technique or restorative technique is probably indicated. This problem with the stability of the treatment outcome should be balanced against the choice of other irreversible, more destructive restorative techniques, many of which may often have a similar life expectancy. Either way, the patient should be warned about the risk before starting treatment.

牙体组织的保存

作为一种保守的治疗技术，漂白使许多患者感到舒适，也比那些贴面或冠等更具破坏性的技术更易于接受。特别是年轻的患者，当他们一旦了解到修复体可能仅能维持几年后，更是如此。早年做的修复体极有可能需要日后更换几次，每次重做都不可避免地要失去更多的牙体组织。这样反复的治疗将会导致牙齿活力的丧失以及对剩余的牙体组织严重破坏。

Preservation of Tooth Tissue

Many patients will feel comfortable with bleaching as a conservative technique and will accept this treatment over more invasive ones, such as veneers or crowns. This is especially true of younger patients once they realise that restorations may last only a few years. A restoration placed early in life will in all probability need to be replaced many times, resulting inevitably in the loss of more tooth tissue each time it is replaced. In due course repeated treatments will lead to a loss of vitality and critical weakening of the remaining tooth tissues.

到底该选择漂白还是进行贴面或冠修复，取决于患牙的修复情况。一般说来，漂白应该适用于完好的或仅需要极少修复的牙。需要大面积修复的

The choice whether to bleach teeth or provide veneers or crowns depends on the restorative status of the teeth to be treated. Generally speaking, bleaching should be

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牙可能更适合采用冠修复。漂白仅能淡化牙齿的颜色，而不是修复体的颜色。因此，若有大面积的修复体存在，则漂白后必须拆除重做。随着时间的推移，漂白后的牙体颜色会逐渐变暗，而重新修复的复合树脂却会保持颜色稳定不变，最终导致二者颜色不匹配。

undertaken only on sound or minimally restored teeth. Teeth with extensive restorations are probably more appropriately treated with crowns.The bleaching process lightens the teeth but not restorations. Therefore, if extensive restorations are present they will need to be replaced following bleaching. Over time bleached tooth tissue may darken but the colour of the replaced resin composites will remain stable, resulting in a colour mismatch.

副作用

活髓漂白术最常见的副作用是牙颈部敏感，发病率高达50%。大多数患者都可以承受，并且不影响他们的生活质量，也不会损伤牙髓活力。换句话说，在漂白结束后数天患者的症状就会消失。对于那些无法忍受牙敏感的患者，应终止治疗。笔者发现如果在漂白的同时每天使用一种含氟漱口水和（或）在漂白之前使用一次的牙本质脱敏剂，都可以减少敏感。

Side-effects

The most common side-effect with vital bleaching is cervical sensitivity, which can have an incidence as high as 50%. In most patients this is tolerable and does not interfere with the quality of life of the patient, nor is it likely to compromise the vitality of the tooth. In others, the symptoms disappear within a few days. In cases in which the sensitivity becomes unbearable for patients treatment should be discontinued. The authors have found that concurrent use of a daily fluoride mouthwash and/or the once-only application of a dentine desensitiser, often pre-treatment, help to reduce sensitivity.

对整个漂白过程进行监控是非常重要的，即在整个治疗过程中为患者提供建议和帮助。一些从业医师通过控制提供给患者的漂白剂的支数，促使患者每1～2周来复诊一次。而另一

It is important to supervise the bleaching process, providing the patient with advice and support during the procedure. Some practitioners manage this by providing patients with a limited number of tubes

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些医师则让他们的患者按时复诊，以确保任何问题都能得到有效、安全的解决。建议在漂白治疗期间，每周复诊一次是比较合适的。

of bleaching agent and reviewing the patient at one- or two-week intervals. Others will regularly review their patients to ensure that any problems are managed effectively and safely. It is suggested that weekly reviews during the active treatment phase are preferable.

适应证

活髓漂白术适用于以下情况：

- 轻度的广泛性着色。
- 增龄性牙齿变黄（图 3-2）。
- 轻度的四环素着色。
- 极轻微的氟斑牙。
- 获得性表面着色。
- 烟斑。
- 吸收性和渗透性着色（茶和咖啡）。
- 牙髓损伤导致的牙体变色。
- 患者主观要求用非破坏性方法

Indications

Vital bleaching procedure is considered to be indicated for the following conditions:

- Mild generalised staining.
- Age-related yellow discoloration (Fig 3-2).
- Mild tetracycline staining.
- Very mild fluorosis.
- Acquired superficial staining.
- Tobacco staining.
- Absorptive and penetration stains (tea and coffee).
- Colour change related to pulpal trauma.
- Patients who request a non-interven-

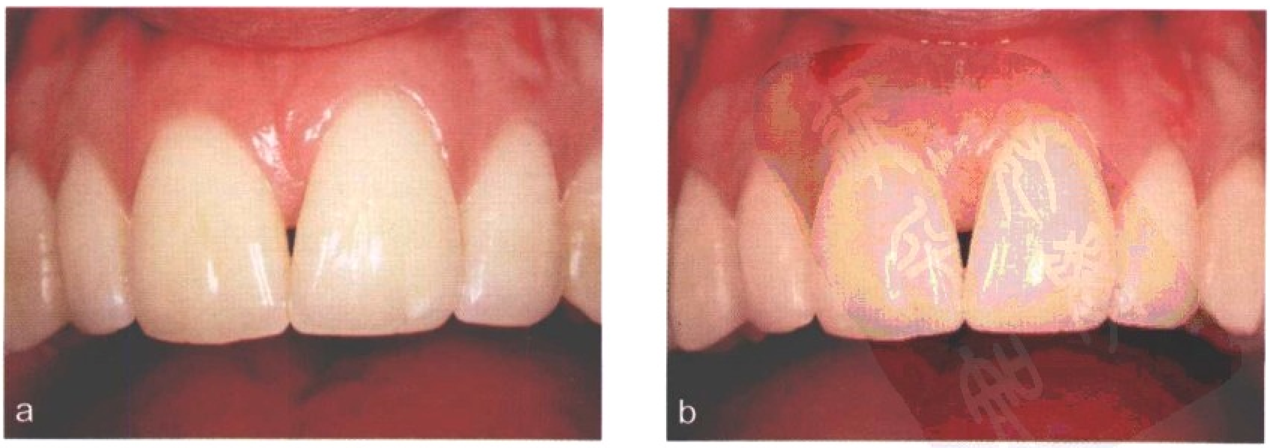


图 3-2　a. 牙齿变黄；b.用 10% 过氧化脲漂白 2 周后
Fig 3-2 (a) Yellow discoloration. (b) After bleaching for two weeks with 10% carbamide peroxide.

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治疗牙齿变色。

- 有遗传性灰黄色牙齿的年轻人。

禁忌证

下列情况不适合做活髓漂白术：

- 严重的四环素着色牙、窝沟发育不良和氟斑牙。着色程度越严重，如四环素牙和氟斑牙，对漂白剂的反应越迟钝，因而比起增龄性着色牙的患者，需要患者有更好的依从性。

- 髓腔大的青少年着色牙患者。

- 期望值过高的患者。
- 牙体上有大面积的、不合适的或有缺陷的修复体者，不能使用活髓漂白术，因为漂白剂有可能渗透到修复体和牙体之间的界面引起牙体敏感。应采用冠等更恰当的方法来改善牙体的外观。因此，漂白术更合适于牙体完整的或不怎么需要修复的牙齿。

- 过度磨耗的牙，尤其是磨损牙。

- 表面有很深的裂痕或折裂纹的牙。

tive approach to the management of their tooth discoloration.

- Young patients with an inherited grey or yellow hue to their teeth.

Contraindications

Vital bleaching is contraindicated as follows:

- Severe tetracycline staining, pitting hypoplasia and fluorosis stain. The more intense, stains such as tetracycline or fluorosis, respond slowly and therefore require greater compliance from the patient than an age-related stain.
- Discoloration in the adolescent patient with large pulps.
- Patients with unrealistic expectations.
- Teeth with extensive, inadequate or defective restorations contraindicate the technique, as there is a possibility that the bleaching agent will penetrate tooth restoration interfaces to cause sensitivity. More appropriate techniques, such as crowns, should be used to improve the appearance of the tooth. Therefore, the technique is more suitable for sound or minimally restored teeth.
- Teeth with excessive tooth wear—in particular, erosion.
- Teeth with deep surface cracks and fracture lines.

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- 根尖有病变的牙。
- 折断牙。
- 怀孕期或哺乳期妇女。
- 对冷、热、触或甜特别敏感的牙。
- 对提出的治疗方案缺乏依从性的患者。

优　点

活髓漂白术具有以下直接有利于患者优点：

- 保存牙体组织。
- 简单快捷。
- 易于为从业医师掌握。
- 成本低。
- 术后不适的风险小。

此外，患者可以合理地了解治疗的进度并很快看到疗效。

缺　点

相反，活髓漂白术也有以下的缺点：

- 家庭漂白术需要患者的积极参与。治疗中的失访率高达 50%，这就产生了一个问题：当患者提出改善其牙齿外观的要求时，他们到底有多在乎这些牙齿。它警告我们可能需要进一步实施其他更具破坏性的治疗。

- Teeth with apical pathology.
- Fractured teeth.
- Pregnant women or nursing mothers.
- Teeth excessively sensitive to heat, cold, touch and sweetness.
- Lack of compliance with proposed regime.

Advantages

Vital tooth-bleaching has the following advantages, which are of direct benefit to the patient:

- Conservative of tooth tissue.
- Simple and fast.
- Easy for practitioners to monitor.
- Cost-effective.
- Low risk of postoperative discomfort.

In addition, patients can, within reason, dictate the pace of treatment and see results relatively quickly.

Disadvantages

In contrast, the technique of tooth-bleaching is considered to have the following disadvantages:

- Active patient participation is required for home-bleaching. The dropout rate from treatment can be as high as 50%. This draws into question how seriously concerned some patients are when requesting treatment to improve the appearance of their teeth, which serves as a warning if more destructive pro-

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cedures are undertaken.

- 颜色的改变与使用的剂量和时间有关。
- 此技术易被滥用。
- 对容易恶心的患者而言，牙托系统是个问题。

- Colour change is thought to be both dose- and time-dependent.
- The technique is open to abuse.
- A tray-based system can be a problem for patients who are prone to retching.

临床技术

活髓漂白术的临床步骤如下：

- 询问现病史和牙科史。
- 检查软组织。
- 检查牙列，注意所有部位牙龈退缩的程度。
- 询问并测试过敏情况，并记录。
- 记录釉质上的白色斑点区，并告知患者，在这些区域得到改善之前，可能会有一个更加恶化的过程。
- 测试需漂白牙的牙髓活力，有临床症状的需拍牙片。
- 如果需要综合治疗，可考虑使用诊断蜡型。
- 明确诊断并制定一个治疗计划。
- 通常一次漂白一个牙弓，多从上颌开始。
- 医师和患者应就哪些变色牙需要漂白治疗达成一致。
- 取得患者的知情同意，这必须包括向患者讲明漂白的益处、风

Clinical Technique

The clinical stages of the technique are as follows:

- Take a medical and dental history.
- Examine the soft tissues.
- Chart the dentition, noting the extent of any gingival recession.
- Ask about and test for sensitivity and record it.
- Record white spots areas on enamel and inform the patient, as these might get worse before they get better.
- Check the vitality of the teeth to be whitened and take radiographs where indicated clinically.
- Consider a diagnostic wax-up if combined treatments are proposed.
- Make a diagnosis and formulate a treatment plan.
- Normally one arch is bleached at a time, usually starting in the maxilla.
- The discoloured teeth to be bleached are agreed by the patient and dentist.
- Obtain informed consent. This must include a discussion of the benefits,

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险、优点、缺点、费用以及漂白的合法性等。切记不要向患者保证特定的治疗效果，并确保患者明白自己在治疗过程中的义务。

risks, advantages, disadvantages, costs and the legal status of bleaching procedures. Be wary of promising a specific outcome and make sure patients understand their commitment to the procedure.

- 首先完成除前牙修复以外的其他治疗（图3-3）。折断牙或髓腔暴露牙应先做适当的暂时性治疗，并告知患者这样做的目的。
- 取藻酸盐材料印模。
- 完成技工室设计，并制作漂白牙托。
- 在技工室用真空搅拌机搅拌石膏灌注工作模型。
- 制作储药囊。即在需漂白牙的唇面涂上一薄层代型间隙剂，也可用指甲油或分离剂（图3-4）。涂层的边缘线应恰好止于龈缘以下。涂层材料的作用是为漂白凝

- Complete other treatment first, except anterior restorations (Fig 3-3). Fractured teeth or open cavities will need appropriate temporization. Warn the patient why you are doing this.
- Take an alginate impression.
- Complete a detailed laboratory prescription to produce a bleaching splint.
- In the laboratory the impression is cast in vacuum-mixed stone.
- Reservoirs can be provided. This is achieved by painting a thin coating of die relief, nail varnish or a separating agent over the labial surface of the teeth to be bleached (Fig 3-4). The fin-

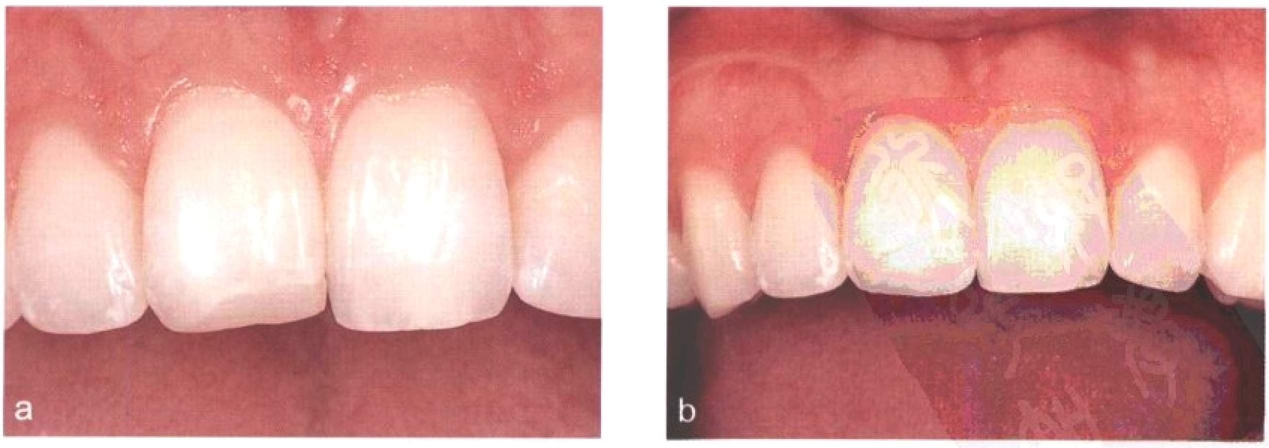


图3-3 a. 患者漂白后前牙修复体需要重新更换；b. 患者换上了新的切端树脂修复体

Fig 3-3 (a) Patient post-bleaching with an anterior restoration that requires replacement. (b) Patient with new incisal edge resin composite.

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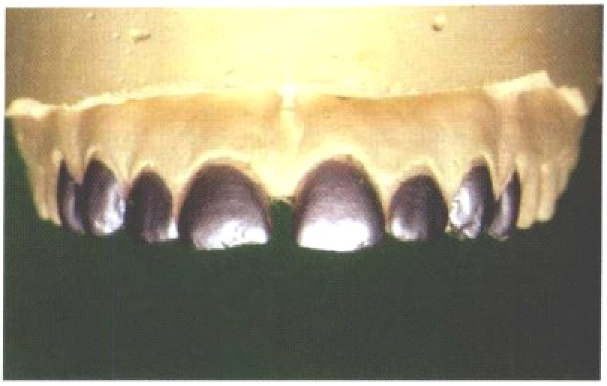


图 3-4 放置树脂以形成储药囊
Fig 3-4 Block out resin placed to form reservoirs.

胶提供储药空间。有证据表明储药囊对漂白并没有益处，是否制作储药囊取决于医师的个人经验。

ish line of the coating should be kept just below the gingival margin. The material acts as a space reservoir for the bleaching gel. There is some evidence that reservoirs confer no advantage to bleaching, and the decision about whether to include reservoirs rests with individual experience.

- 修整模型，去除锐利的边缘。应修整模型的基座高度，使其整体高度尽可能降低，过高的模型会使牙托在真空压膜机内撕裂。

- The model is then trimmed to remove sharp edges. The base height of the cast should be trimmed so that the overall depth of the cast is as minimal as it can be. Casts with excessive height can cause the splint material to tear in the vacuum-forming machine.

- 用厚度为 1 mm 的多聚乙烯薄片经真空压膜成形，盖在变色牙的模型上。
- 然后沿颈缘自然外形在龈缘下 0.5～1 mm处修剪漂白牙托，可以用橡皮轮或火焰枪将过锐的边缘磨光。

- A thin 1mm polyvinyl sheet is vacuum formed over the model around the discoloured teeth.
- The splint should then be trimmed to 0.5–1mm below the gingival margin following the natural contour of the gingival margins. The sharp edges can be smoothed either with a rubber wheel or by gently using a flame gun along the edges.

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• 牙托应覆盖全部殆面，但不必覆盖腭部，通常仅包住牙冠便足以，因为牙托的固位主要源于漂白凝胶的黏性，而不是倒凹或是覆盖硬腭的面积。

• 给患者一份书面指导，内容包括牙托的护理和漂白剂的使用方法（图3-5和图3-6）。牙托可以用牙刷和牙膏来清洁。

• 牙托中所需要的漂白凝胶的最适量很少，多数厂家将凝胶设计成注射器形式。两支注射器的量足够单颌牙漂白2周之用。通常仅给患者提供几支药，一般情况是一次给3支，这样患者需要更多的药就必须来复诊，因为漂白治疗要求临床医师密切关注治疗的全过程。如果给了患者过多

• The tray should cover all occlusal surfaces but need not cover the palate. It is usually sufficient just to envelop the crowns of the teeth, as the retention of the splint is mainly gained from the bleaching gel being viscous rather than undercuts or coverage of the hard palate.

• Give the patient written instructions regarding care of the tray and application of the material (Figs 3-5 and 3-6). The tray can be cleaned with a toothbrush and toothpaste.

• The optimal amount of bleaching gel needed in the splints is small. Most manufacturers supply the gel in syringe form. Two syringes are more than sufficient to treat a single arch for a period of two weeks. It is normally convenient to supply a few syringes – typically three at a time – so that the patient needs to return for more if



图3-5 将漂白凝胶放置到牙托内

Fig 3-5 Bleaching gel being applied to the tray.



图3-6 将带药的牙托就位

Fig 3-6 Tray loaded and in place.

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的漂白剂，如4支或更多，他们就有可能滥用。目前，英国的厂家尚未提供患者使用的说明书，因此各个临床医师必须自行确定自己的治疗方案。

needed, as this allows the clinician to monitor closely the progress of treatment. If a patient is given an excessive number–for example, four or more syringes–it is possible that they might abuse the product. Currently manufacturers in the UK are not supplying instructions for patient use, so individual practices must therefore develop their own protocols.

• 进一步强调敏感发生的可能性。
• 给患者提供漂白剂，并告知患者牙托必须每天佩戴6～8 h，通常是整晚使用。要求患者填一张日常使用作息表。漂白次数越多，漂白作用就越快。通常2周便可出现显著效果，但也有些病例需要更长的时间。这可能是由于牙齿着色程度重，或者患者的依从性较差。克服患者依从性差是很难的，这通常是漂白失败的前兆。如果患者不能按照医嘱佩戴牙托，致使漂白剂与牙体的接触时间不够长，就会导致治疗失败。增加使用次数并更换漂白剂是最有效的方法。此项技术最初建议整晚漂白，但对某些患者而言，另一个更好的方法是傍晚和周末配戴牙托。同样，有些患者愿意在白天佩戴，但是对于全日制工作的患者来说，困难会更大一些。

• Reinforce the possibility of sensitivity.
• Dispense the bleaching material and advise that the splint is worn for six to eight hours, usually overnight. It is helpful to ask the patient to complete a diary sheet. The more often the bleach is applied the quicker the process. Normally, a favourable outcome can be achieved within two weeks, but in some the process takes longer. This might reflect the severity of the discoloration or reduced patient compliance. Overcoming the latter is difficult and often an indicator of failure. If the patient fails to wear the splint as directed then the bleaching agent is in contact with the teeth for insufficient time and treatment fails. Frequent use and change of agent is the most effective regimen. Overnight bleaching was suggested initially for this technique but a better option, for some patients, is to wear the splint in

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the evenings and at weekends. Equally some patients are content to wear the splint during the day, but this can be more difficult if the patient works fulltime.

- 开一些含氟漱口水白天使用。
- 安排患者一周后复诊，如果出现牙敏感的问题可提前复诊。

- Prescribe fluoride mouthwash for daily use.
- Arrange a review after one week with the proviso that the patient returns earlier if sensitivity proves to be a problem.

复　诊

建议每次复诊时的常规检查内容如下：

- 检查软组织有无炎症，尤其是有无牙托造成的创伤。
- 如果发生严重的牙敏感问题，应终止漂白。
- 如果牙敏感的程度正逐渐加重，建议使用几天漂白剂，再在牙托里使用几天脱敏牙膏。
- 比色并与最初的色标进行比较。
- 拍照。
- 预约下一周的复诊。
- 每周坚持复诊。
- 向患者解释漂白变化多发生在漂白开始后的几小时或几天内，而比色在治疗的维持阶段会稳定下来。

Review Appointments

It is recommended that the following routine is adopted at each review appointment:

- Examine the soft tissues for signs of inflammation, specifically trauma from the tray.
- Bleaching should be discontinued if severe sensitivity is being experienced.
- If sensitivity is increasing in severity, recommend bleaching on alternate days, perhaps using desensitising toothpaste in the splint on other days.
- Check shade against the original shade tab.
- Take photographs.
- Arrange review in a further week.
- Continue to review weekly.
- Explain to the patient that most of the bleaching change occurs in the first few hours and days after the bleaching has started and the shade is con-

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• 何时结束治疗应由医师和患者共同讨论决定。大多数简单的治疗只需要数周（通常是 2 周）。

• 整个治疗结束以前都要监控患者的情况。

• 明智的做法是使漂白牙漂得稍微过亮一些，因为常常会有某种程度的反复。

• 强调可能需要强化漂白治疗。

• 记录下治疗结束时牙齿的比色并拍照。

死髓漂白术

病例选择

通常情况下，死髓牙的变色原因是由于牙本质内血液成分的降解，导致牙齿变黑。变黑可发生在牙髓失活之后不久，也有些病例发生在失活很长一段时间以后。颜色很深的牙比起轻度变色的牙需要更长的时间漂白。因此，对于初次漂白的患者，轻、中度着色牙比重度着色牙漂白成功的概率大得多。

重度着色牙很难治疗。死髓漂白术通常无法完全成功，它可能需要和

solidated over the remaining period of treatment.

• When to stop treatment should be a joint decision made by both clinician and patient. Most simple cases are bleached within a few (usually two) weeks.

• Don't be tempted to discharge the patient until treatment is complete.

• It is advisable to overlighten slightly as there is usually some relapse.

• Reinforce that top-up treatments will be required.

• Record end-of-treatment shade and photograph.

Non-Vital Bleaching

Case Selection

Normally the cause of discoloration of non-vital teeth is the breakdown of blood products within dentine, which results in a darkened tooth. This process may occur soon after the loss of vitality but in other cases the process occurs over longer periods of time. Very dark teeth will take more time to whiten than mildly discoloured teeth. Therefore, for first-time users of this technique a mild to moderate stain will have a greater chance of achieving a successful outcome than a more intense one.

Very intense stains are difficult to manage. Non-vital bleaching is often not

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贴面修复技术联合使用，或者在大多数情况下会用到全冠间接修复术，如金属烤瓷冠。由于很难预料漂白后的牙色，因此不建议采用透明的全瓷冠修复，因为变色牙的颜色仍可透过冠显现出来，影响修复体的最终颜色。除非采用一种特殊的全瓷系统，如Procera系统，因为它有一个遮色的氧化铝内冠。

completely successful. The technique may have to be used in conjunction with a veneering technique or in extreme circumstances a full coverage indirect restoration such as a metal ceramic crown will be required. Because colour predictability can be difficult, a translucent all-ceramic crown may not be advisable, since the darkened tooth may still show through the crown and affect the ultimate shade of the restoration unless a system such as Procera has been used, which has an opaque alumina coping.

过硼酸钠

过硼酸钠，顾名思义，是另外一种过氧化氢的衍生物，它在水的作用下降解为偏硼酸钠、过氧化氢和新生氧。这种材料用于死髓牙漂白已经多年，称为"走动漂白技术"，最初是由Nutting和Poe（1967）提出，将过硼酸钠用于漂白死髓牙。过硼酸钠可以和过氧化氢混合使用以加强其作用效果。因此，大多数用于漂白死髓牙的高性价比漂白产品，都是由体积比为10%或3%的过氧化氢和过硼酸钠混合而成的浆状物，呈湿砂状。这两种材料都可以在当地药店或医院的药房中买到。理论上加热可以用于加快椅旁的反应速度，但现在已不再采用，并且明确禁止加热，因其可能导致根的外吸收。

Sodium Perborate

Sodium perborate, as the name suggests, is another derivative of hydrogen peroxide, which breaks down in the presence of water to form sodium metaborate, hydrogen peroxide and nascent oxygen. This material has been used for years to bleach non-vital teeth using the "walking technique" —originally described by Nutting and Poe (1967), making sodium perborate the material of choice for bleaching non-vital teeth. Sodium perborate can also be mixed with hydrogen peroxide to potentiate the effect. The most cost-effective bleaching product for the bleaching of non-vital teeth therefore is a combination of 10 volumes or 3% hydrogen peroxide and sodium perborate mixed into slurry, which is not unlike wet sand. Both materials can usually be purchased through a local or hospital

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pharmacy. In theory heat can be used to increase the speed of reaction at the chairside. This is no longer indicated, however, and is positively contraindicated because of the potential for external root resorption.

副作用

现在死髓漂白术的副作用很少，非诊室漂白技术已被绝大多数临床医师所采用。以往，采用加热来激活过氧化氢，但这样做增加了热扩散到周围龈组织的可能性。温度一旦上升超过4℃，组织就会失活，通常会导致根外吸收的发生。

Side-effects

The side-effects reported for non-vital bleaching are rare now that the walking technique has been adopted by a majority of practitioners. Previously, heat was used to activate the hydrogen peroxide, which increased the potential for heat to be transmitted to the surrounding gingival tissues. Where a temperature rise above 4℃ occurs vital tissue can die, and a common consequence of this could be external root resorption.

技术操作

临床技术步骤如下：

- 取得知情同意。
- 给需要治疗的牙拍X线片排除根尖病变，检查根管治疗的质量。如果对根管治疗的质量存在任何质疑，在开始漂白前就应谨慎地重新做根管治疗。

Technique

The clinical stages of the technique are as follows:

- Obtain informed consent.
- Make radiographic assessments of the tooth/teeth to be treated specifically to exclude apical pathology and check the quality of the root canal treatment. If there is any doubt about the quality of the root canal therapy it is prudent to provide revision endodontic therapy before starting the bleaching procedure.

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- 更换所有不良修复体，常常足以使一些病例的牙体外观得到改善。
- 用按明度排列的比色板记录下治疗前的颜色。
- 对于那些需要有效封闭的牙齿用橡皮障进行隔离。橡皮障的封闭作用可以通过专用的橡皮障封闭剂来加强。从窝洞中去除所有的修复材料，特别注意将窝洞唇侧壁上的残留修复材料去除干净，因为它们有可能使牙体颜色变暗。
- 修整窝洞并将其扩展至髓角，任何残存在窝洞唇侧壁上的着色或变暗的牙本质都应用钻磨去，应小心操作不要过多去除牙本质，因为去除过多可能会使牙体变脆。
- 用非切削钻（如Gates Glidden，Dentsply Maillefer，France等）去除牙胶至龈缘以下，在牙胶上方留出空间填塞一层保护性垫底材料，这就意味着，常常需要去除牙胶至根管口根方至少5 mm。
- 不要酸蚀窝洞，因为尚无任何证

- Replace any defective restorations, which in some cases is often enough to improve the appearance of the tooth.
- Record baseline shade using a shade guide arranged in order of value.
- Isolate the tooth with rubber dam, which needs to be an effective seal. The seal of the rubber dam can be reinforced by the use of a rubber-a dam sealant. Remove all restorative material from the access cavity, paying special attention to remove any remaining restorative material from the labial walls of the access cavity, as it might be contributing to the darkness of the tooth.
- Refine the access and extend it to include the pulp horns. Any remaining darkened or stained dentine overlying the labial wall of the access chamber should also be removed with a bur. Care should be taken not to overdo this, as it might weaken the tooth.
- Remove gutta percha with a non end-cutting bur (for example, Gates Glidden, Dentsply Maillefer, France) to well below the gingival margin to allow space for a protective base overlying the gutta percha. This usually means that the gutta percha needs to be removed to at least 5mm down the radicular part of the root canal.
- Do not etch the access chamber as there

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据表明在使用漂白产品前酸蚀窝洞有什么益处；然而，酸蚀所需要的时间很短，且能使漂白剂易于渗透。

is little evidence to suggest that acid etching before loading with the bleaching product confers any advantage; however, it takes very little time and may allow easier access for the bleaching agents.

- 在牙胶上铺一层惰性垫底材料，以降低漂白剂渗透到根尖组织的风险。通常使用的惰性材料有磷酸锌、传统型或树脂改良型玻璃离子粘固剂、复合树脂。复合树脂提供了一层封闭层因而更受欢迎。

- Place an inert base over the gutta percha to reduce the risk of the bleaching materials passing down to the apical tissues. Commonly used materials are zinc phosphate, traditional or resin-modified glass-ionomer cements or resin composites. The later materials are to be preferred, as they provide for a seal as well.

- 将过硼酸钠和过氧化氢混合成湿沙状混合物。

- Mix the sodium perborate with hydrogen peroxide to achieve a "wet sand" mix.

- 将漂白混合物小心地放置于垫底材料上，并将其紧压于牙体组织的唇侧壁上，为棉球预留出足够的空间。对于大多数牙体制备，窝洞的大小要满足用肉眼能看见根管，这样才足够容纳过氧化氢和过硼酸钠浆剂（图 3-7）。

- Place the mixture carefully over the base material and pack it against the labial wall of the tooth, leaving sufficient space for a small cotton wool pledget. For most endodontic procedures the size of the access cavity required to gain visible access to the root canal is of sufficient size for placing a slurry of hydrogen peroxide and sodium perborate into the tooth(Fig3-7).

- 用有效的临时粘固剂封闭窝沟，如氧化锌和丁香油、IRM（中间修复材料，Dentsply Ltd，UK）或普通玻璃离子粘固剂。

- Seal the access cavity with effective temporary cement – for example, zinc oxide and eugenol, IRM (Intermediate Restorative Material, Dentsply Ltd, UK) or a conventional glass-ionomer

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图 3-7　放好的过硼酸钠
Fig 3-7　Sodium perborate in place.

cement.

- 去除橡皮障。
- 向患者强调，漂白过程非常花费时间。患者应每周复诊，当牙齿颜色改变能满足患者需要时，就可以结束治疗了。每次复诊时，都要替换新配置的过氧化氢和过硼酸钠混合物。
- 漂白过程完成后用复合树脂修复窝洞（图 3-8），为了防止进一步的着色，有效的封闭窝洞是非常重要的。比较受欢迎的窝洞充填材料是复合树脂。明智的做法

- Remove rubber dam.
- Emphasise to the patient that the procedure will take time. The patient should be reviewed at weekly intervals and treatment is completed when the colour change satisfies the patient's needs. At each review appointment the materials should be replaced with freshly mixed hydrogen peroxide and sodium perborate.
- Restore the access cavity with resin composite when the bleaching process is complete (Fig 3-8). To prevent further discoloration, it is important to seal the access cavity effectively. The

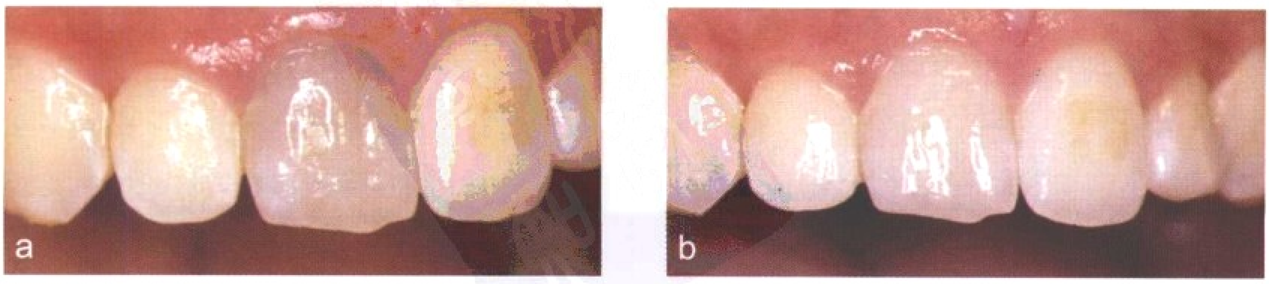


图 3-8　a. 死髓变色的上颌中切牙；b. 死髓漂白术后
Fig 3-8　(a) Discoloured non-vital upper central incisor. (b) After non-vital tooth bleaching.

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是，选用较浅色的、更透明的树脂来进一步美白牙体。

preferred material for doing this is resin composite. It is sensible to use a light, more translucent shade further to lighten the tooth if this is required.

优　点

死髓牙漂白术的主要优点是保存了牙体组织。同样，还避免了用冠修复来恢复牙体颜色，同时成功地降低了制作与邻牙颜色匹配的单冠的难度。根管治疗后，牙体组织的强度通常会降低，冠预备会去掉很多牙体组织并可能会削弱牙体的唇侧壁强度，以至于唇侧壁完全丧失，需要用桩冠来修复患牙。用桩冠修复的牙，其长期预后是相当差的。因此，死髓牙漂白术可以通过避免桩冠修复来延长牙齿的寿命。

Advantages

The main advantage of the technique is that it is conservative of tooth tissue. However, equally important is the benefit of eliminating the need for a crown to restore the colour of the tooth, let alone the difficulties of providing a single crown to match the colour of the adjacent teeth successfully. Following root canal treatment, the strength of the tooth is frequently compromised. A crown preparation will remove even more tooth tissue, possibly weakening the labial wall of the tooth to such an extent that it is lost and a post crown is needed to restore the tooth. The long-term prognosis of post-retained crowns is relatively poor. Bleaching non-vital teeth is therefore likely to prolong the life of the tooth by avoiding the need for a post-retained crown.

副作用

如果按照上述步骤来操作，死髓牙漂白术几乎没什么副作用。最难漂白的部位通常是牙齿的颈缘，可能是因为根管内根方的牙胶去除得不够，或是因为使用了过多的封闭根管材料，也许仅仅是因为这部分牙体组织就是

Side-effects

There is little potential for side-effects if the technique described above is followed. The most resistant part of the tooth to bleaching is often the gingival margin, possibly because insufficient gutta percha has been removed from the radicular part of the

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更难漂白。不论是哪种原因，在漂白开始之前都要提醒患者这些问题存在的可能性。漂白引起牙体变脆或增加折裂的可能性非常小，牙折裂的可能性更多地取决于预备窝洞的大小。窝洞预备应在保证牙髓治疗方便的前提下尽可能地减小，但其大小又应满足漂白治疗的需要。

root canal or too much material has been placed to seal off the root-canal treatment. Or it may simply be that this part of the tooth is more resistant to bleaching. Either way it is often helpful to warn the patient of this potential problem before treatment is commenced. There is little potential for the bleaching procedure to weaken the tooth and increase the potential for fracture. The potential for fracture will largely depend on the size of the access chamber, which should always be kept as small as possible to allow good access for the endodontic procedures but large enough for the bleaching process.

联合治疗技术

有时从药剂师或医院药房那里难以买到体积比为10%的过氧化氢。有一种过硼酸钠的产品叫Bocasan（Oral B，Gillette Group，IsleWorth，UK），它可降解为过氧化氢和水，过氧化氢的浓度可能太低，无法漂白某些严重变色的牙齿。因此，临床医师更偏爱其他产品，如过氧化脲，它可作为过氧化氢的替代品，以同样的方法使用（即非诊室漂白技术）。

Combination Techniques

Purchasing hydrogen peroxide in a concentration of 10 volumes from chemists or hospital pharmacists can sometimes be difficult. An alternative to sodium perborate is Bocasan (Oral B, Gillette Group, Isleworth, UK), which breaks down to form hydrogen peroxide and water. The concentration of hydrogen peroxide may be too low to brighten intensely darkened teeth. Therefore, practitioners may prefer other techniques. Carbamide peroxide, for example, can be used as a replacement for hydrogen peroxide and employed in a similar manner to that described above (say, for a walking bleaching technique).

另一种漂白牙齿的方法是定制的

Another variation is to bleach the tooth

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载有过氧化脲的成品牙托漂白技术。此方法较易实施，对临床医师来讲材料都是现成的。如前所述，去除根管内冠方1/3的牙胶以达到相同的深度并放置合适的垫底材料。冠部/根管部的垫底材料作为冠部封闭剂用于保护根管治疗的完整性，但是并不需要在每次复诊之间用暂封性材料覆盖窝洞口。真空抽吸成形的牙托与活髓牙漂白使用的方式相同，只不过需要用材料封闭根管口，而将窝洞口敞开。牙托应在唇腭侧均承载漂白材料，使过氧化脲紧贴牙体表面来漂白牙齿。在牙托唇、腭侧面均应制作一小储药囊，以使漂白剂仅作用于这一颗牙上。剪掉邻牙上的牙托，同样有助于确保漂白凝胶不影响邻牙。一旦过氧化脲渗漏到唾液中，就会被酶降解失活。

with the aid of a custom-made splint loaded with carbamide peroxide. This technique is probably easy to achieve because the materials are readily available to practitioners. As before, gutta percha is removed from the coronal third of the radicular canal to the same depth and a suitable base placed. The coronal/radicular base is required to protect the integrity of the root treatment providing for a coronal seal but an inter-appointment provisional material over the access chamber is not necessary. A vacuum-formed splint is used in the same way as for vital bleaching but, instead of sealing the material inside the pulp chamber, the access chamber is left unsealed. The vacuum-formed splint loaded labially and palatally can deliver the carbamide peroxide close to the tooth surface, so bleaching the tooth. The vacuum-formed splint should have a small reservoir made on the labial and palatal surface to limit the bleaching process to the single tooth. It is also helpful to cut back the splint on the adjacent teeth to ensure the bleaching gel cannot affect these teeth. Once the carbamide peroxide leaks into the saliva it is readily de-activated by enzymes.

诊室漂白技术

过氧化脲（过氧化氢）可以使用很高的浓度20%～35%（6.6%～11.5%），远远高于家庭漂白的浓度

In-Surgery Techniques

Carbamide peroxide (hydrogen peroxide) can be supplied in higher concentrations of 20-35% (6.6-11.5%) rather than the 10%

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10%（3.3%）。因为这种材料是有腐蚀性的，所以在口内使用时必须特别小心。

(3.3%) used for home bleaching. The material is therefore caustic and, as a consequence, great care is needed when applying it in the mouth.

病例选择

有些患者要求即刻的诊室漂白效果，而不喜欢家庭漂白术的滞后效应。这种诊室漂白技术和材料是通过在牙体表面使用高浓度漂白剂起作用的，不管是否使用光照活化，都可以加快漂白进程。某些患者，联合使用诊室漂白和家庭漂白两种方式更有效。要知道很重要的一点是，每位患者对治疗的反应都不同，联合治疗可能更加有效。诊室漂白的优点是，临床医师可以更好的控制漂白剂的使用，而不需要依赖患者的依从性。但椅旁操作时间较长，因此必须找到一种平衡的方法，对不同的病例区别对待。临床医师进行操作最终疗效是否强于家庭漂白术目前尚有争议。

Case Selection

Some patients request an immediate in-surgery result rather than a delayed outcome as achieved with the home techniques. The in-surgery techniques and materials achieve faster bleaching by using high concentrations of bleaching agent at the tooth surface with or without activation by light. In some patients a combination of in-surgery and home bleaching is helpful. It is important to realise that patients will respond differently and a combination of treatments may be appropriate. The in-surgery techniques have the advantage that the clinician has more control on the application than when relying on patient compliance. Chairside treatment time is, however, longer. A balance must therefore be achieved, and each case will be different. Arguably, the practitioner has less control over the final result than when a home-bleaching technique is used.

临床步骤

诊室漂白法使用高浓度的过氧化脲或过氧化氢，它们接触软组织，就可能灼伤。漂白剂在牙体表面使用15~30 min，可以使用家庭漂白术中使用的

Clinical Stages

In-surgery techniques use concentrated carbamide peroxide or hydrogen peroxide, which have a potential to burn the soft tissues if contact occurs. The bleaching agent

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真空抽吸成形牙托，也可以直接在橡皮障和橡皮障封闭剂隔离的条件下作用于变色牙的牙体表面。可以用带涡轮漂白头的漂白灯来增加过氧化脲的反应速度。但这样做是否有临床意义仍需证实。当使用高浓度漂白剂时，应小心控制牙托边缘的渗漏，因为漂白剂对软组织的损伤太大。大多数漂白技术建议每次就诊的最长漂白时间是20～30 min，而要达到预期的效果则需要复诊多次。

is applied to the surface for 15–30 minutes, either using a vacuum-formed splint similar to home bleaching or directly onto the discoloured teeth under rubber dam isolation used in conjunction with a dam sealer. Bleaching lights with turbo bleaching tips may be used to increase the rate of reaction of the carbamide peroxide. Whether this has any clinical significance remains to be demonstrated. Leakage around the edges of a splint should be carefully controlled when using a higher concentration, as the potential for damage to the soft tissues is much greater. Most techniques suggest 20–30 minutes as the maximum bleaching time at any one appointment, and a number of visits may be required to achieve the desired results.

如果直接应用漂白剂，许多临床医师会采用橡皮障来保护牙龈组织。这可能比使用其他形式的隔湿法安全得多。剪裂橡皮障隔离术是一种折中的办法，它可以保护唇颊组织，但不能保护龈缘。

Many clinicians use rubber dam to protect the gingival tissues if the material is to be applied directly. This is probably much safer than using other forms of moisture control. The split-dam technique is a compromise, which protects the lips and cheeks but not the gingival margins.

诊室漂白法与活髓夜间漂白术比较，下面几点很重要：

- 诊室漂白法的治疗时间可能更长，且一般最少要就诊2次。
- 辅以冷光加强的诊室漂白法延长了椅旁操作时间同时增加了

When in-surgery techniques and vital night-guard bleaching are compared, the following points are of importance:

- In-surgery bleaching treatment times can be lengthy and normally at least two visits are required.
- In-surgery bleaching with power lighting adds to chairside time and equip-

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设备成本，更花费了临床医师的时间，也大大增加了治疗的费用。

- 某些患者由于夜间戴用牙托不方便，选择了较昂贵的诊室漂白法。
- 关于诊室漂白术对软组织灼伤的安全问题已在前面有关诊室漂白技术的章节中阐述了。
- 有证据表明诊室漂白法比活髓夜间漂白术复发快。
- 对于诊室漂白术，复诊和初诊时的费用一样贵。
- 没有临床证据表明诊室漂白法比活髓夜间漂白术效果更好。
- 诊室漂白法对治疗单个变色牙比其他技术更具有优势，但对活髓牙则不然。
- 有报道称，使用高浓度过氧化脲时牙敏感性增加。

ment costs, let alone practitioner time, significantly increasing the cost of treatment.

- For some patients the inconvenience of night-guard bleaching makes up for the procedure the more costly in-surgery.
- Safety concerns over burns to soft tissues have been expressed in relation to in-surgery techniques.
- It has been suggested that regression is quicker with in-surgery techniques compared with vital night-guard bleaching.
- Repeat treatments are as expensive as the initial treatments for in-surgery techniques.
- There is no clinical evidence that in-surgery techniques are more effective than vital night-guard bleaching.
- In-surgery techniques have some advantages over alternative techniques for the treatment of a single discoloured but vital tooth.
- There are reports of increased sensitivity when higher concentrations of carbamide peroxide are used.

其他漂白术

以牙托为基础的漂白系统可产生7个Vita比色板色标的颜色改变，与之相比，其他漂白方法只能增加3～4个Vita比色板色标的颜色。而与牙托系统

Other Bleaching Techniques

Compared with a tray-based system, which can produce a shade change of seven shade tabs on the Vita shade guide, other bleaching techniques can produce an in-

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和诊室漂白法比较，其他的漂白系统不需要医师的处方，可以在柜台上购买得到。研究中发现，色相的变化在某种程度上是个较慢的过程，是一种渐进式的改变。这种变化通常很微妙以至于患者不能完全满意，这可能就是这类漂白系统的明显缺点。但是，这些漂白系统在漂白已经相当白的牙齿时（A3或者更白的牙齿），或是作为活髓夜间漂白术或诊室漂白术的强化治疗手段却有一定的地位。因此，对于从业医师来说，了解这些柜台漂白技术和它们的作用原理是非常重要的。

crease in value of 3—4 Vita shade tabs. In contrast with traybased and in-surgery techniques these other bleaching systems can be purchased over the counter without the prescription of a dentist. The change in value is a somewhat slower process, with gradual increases in value noted in scientific studies. This change is often too subtle for the patient to fully appreciate and this could be considered a significant disadvantage of systems of this type. However, they probably have a place in the bleaching of already fairly white teeth (A3 or greater) or for top-up treatments between courses of vital night-guard bleaching or in-surgery techniques. It is important for practitioners, therefore, to be aware of the existence of these over-thecounter techniques and to have some knowledge of how they work.

Whitening Strips™

Whitening Strips™（Proctor&Gamble，USA）是2000年进入美国市场的产品。这种膜状物是具有弹性的多聚乙烯漂白药膜，呈凝胶状，直接向接触的前牙唇面释放过氧化氢。这种些药膜含有6.5%过氧化氢，一般推荐治疗周期是2周（图3-9）。

Whitening Strips™

Whitening Strips™ (Proctor & Gamble, USA) were introduced to the US market in 2000. The strips are flexible polyethylene bleaching strips that are designed to deliver hydrogen peroxide in gel form directly to the labial surface of anterior teeth. The strips contain 6.5% hydrogen peroxide, and a two-week treatment period is typically recommended (Fig 3-9).

局部应用装置

目前美国市场上出现了一种凝胶

Topically Applied Systems

Recently a topically applied tooth-

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状的局部应用型牙齿漂白系统。它含有 18% 过氧化脲（Simple White，Colgate，USA），该系统可释放出 6.03% 的过氧化氢，它通过使用一种特殊的装置引导至治疗牙的唇面（图 3-10）。漂白剂使用 2 周，每天 2 次。研究表明，2周的疗程可以产生3～4个 Vita 比色板上色标的变化（提高色相）（图 3-11）。这种治疗的费用相当低（14.99 美元或 8.25 英镑），目前尚无

bleaching system in the form of a gel has been introduced in the US which contains 18% carbamide peroxide (Simply White, Colgate, USA). The system releases 6.03% hydrogen peroxide. It is applied with a special applicator to the labial surface of the teeth to be treated (Fig 3-10). The agent is applied twice a day for two weeks. Studies have shown that a two-week course of treatment can produce bleaching (increase in



图 3-9　使用中的漂白膜

Fig 3-9　Whitening strips in place.



图 3-10　局部应用美白凝胶

Fig 3-10　Topical whitening gel being applied.

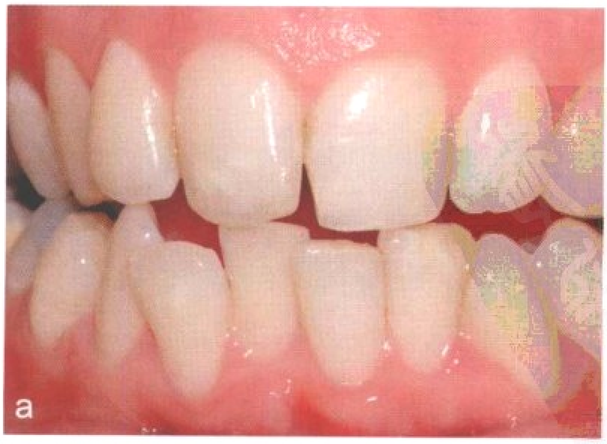




图 3-11　a. 适合于用局部美白装置的局部变色牙患者；b. 局部美白装置使用 2 周后

Fig 3-11　(a) Patient with discoloured teeth suitable for treatment with a topical whitening system. (b) After two weeks of topical tooth-whitening.

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明显副作用的报道。现又已研制出一种欧洲制剂，目前正在试用中。

value) of 3–4 Vita shade tabs (Fig 3-11). The cost for a course of treatment is relatively low ($14.99/ £8.25) and no significant side-effects have been reported. A European formulation has been developed and is currently being trialled.

美白牙膏

患者都希望拥有洁白的牙齿，所以许多牙膏生产厂家都推出了增加牙齿亮度的美白牙膏。实际上，这些牙膏对去除外部着色非常有效，可以改善牙齿的整体外观，但无法改变深层的颜色。因此，这类产品的使用价值是有限的，因为外部着色多发生在牙的舌侧，很少在唇侧面。漂白后使用美白牙膏，可能对减少或防止外部着色的形成起一定的作用，但对维持漂白疗效和美白牙齿的作用还值得怀疑。

Whitening Toothpastes

Patient demand for whiter teeth is such that many toothpaste manufacturers have introduced whitening toothpastes to improve the brightness of teeth. In practice these agents are very effective at removing extrinsic staining, which can improve the overall appearance of teeth but not the underlying colour. This is of limited value, however, as extrinsic stain is more commonly found on the lingual aspects of teeth and is rarely a problem on the labial surface of teeth. Post-bleaching whitening toothpastes possibly do have a place in reducing and preventing the build-up of extrinsic stain, but their value in maintaining bleaching or whitening teeth is doubtful.

微打磨

使用强酸去除釉质上的着色最早在80多年前就有报道。该技术通常与"酸蚀打磨"这个术语联系在一起。它是用浓缩的盐酸小心地作用于着色牙上。此技术的主要问题是，即使使用膏剂，也存在着在口内使用浓盐酸的危险。一旦发生差错，酸不论是溅到口腔

Microabrasion

The use of strong acids to remove stained enamel was first reported over 80 years ago. The technique is normally associated with the term "acid abrasion". It involves careful application of concentrated hydrochloric acid to a stained tooth. The major problems associated with this technique revolve

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软组织或是皮肤上都会发生灼伤，若得不到及时治疗，甚至可以毁容。正因为如此，尽管该技术非常有效，但并没被普遍应用。厂家已生产出含缓冲剂的酸产品，并通过打磨作用去除着色，该产品对于临床医师来讲更具临床实用价值。此外，用碳钨钻打磨局部釉质，一般足以去除着色，如果有必要的话，还可用少量复合树脂来遮盖剩余的着色。此种技术特别适用于局部的点状着色，而不适用于广泛着色的牙齿。

around the dangers of using concentrated hydrochloric acid, albeit in a slurry, in the mouth. If mistakes occur and the acid is dropped onto either the oral soft tissues or the skin the result is burning that, if not treated immediately, can be disfiguring. For this reason the technique, although very effective, has not attained universal acceptance. Manufacturers have produced materials containing buffered acids and abrasives to remove the stain, and these are of more practical use to practitioners. Alternatively, localised reduction of the enamel with a tungsten carbide bur will often remove sufficient stain and, if necessary, a small resin composite restoration can be placed to mask the residual stain. The technique is particularly useful for localised "spots" rather than generalised discoloration.

该技术的其他适应证：

- 局部着色，尤其是氟斑牙。
- 棕色污点，而不是白色斑点（图3-12）。
- 烟斑很重，但不伴有切牙牙本质暴露。

Other indications for the technique include:

- Localised stains, typically found in fluorosis.
- Brown mottling rather than removal of white spots (Fig 3-12).
- Dark smoking stains but not those on incisal teeth where dentine has been exposed.

这种技术不能用于广泛着色牙，如四环素牙或增龄性着色牙，它们更适用活髓漂白术。

The technique is contraindicated for more generalised stains, such as tetracycline or age-related changes, which are best managed by means of vital bleaching.

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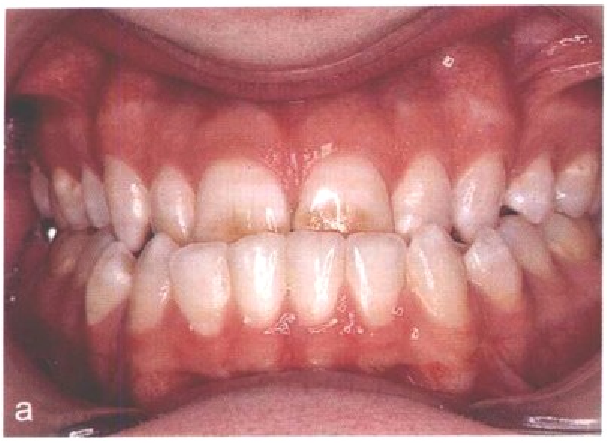




图 3-12 a. 有斑点的变色牙；b. 联合使用微打磨和牙体漂白后

Fig 3-12 (a) Discoloured teeth with mottling. (b) After a combination of microabrasion and tooth-whitening.

临床步骤

微打磨的临床步骤如下：

- 用橡皮障隔离着色牙，确保封闭良好。使用专用的橡皮障封闭剂增加其封闭性。
- 将浓盐酸和浮石粉在玻璃研钵中混合至均匀的湿砂状。
- 也可使用专用的预成混合材料。作者本人较喜欢这种材料。
- 给患者戴上眼罩和保护衣服的塑料胸巾，临床医师和护士也需要有效地保护眼睛及皮肤。
- 小心地用平塑料刀将浮石粉和酸的混合物涂于牙体表面，并用

Clinical Stages

The clinical stages for microabrasion are as follows:

- Apply rubber dam around the stained tooth or teeth, ensuring there is a good seal. A rubber-dam sealer can be used to improve the rubber-dam seal.
- Mix the concentrated hydrochloric acid with flour of pumice in a glass dappens pot to produce a consistency of wet sand.
- Alternatively use a proprietary pre-mixed material. This is the authors' preference.
- Provide the patient with eye protection and a plastic bib to protect their clothing. Both the operator and the nurse also need effective eye and skin protection.
- Carefully apply the pumice and acid mixture onto the tooth surface using a

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杯状橡皮头慢慢搅动材料，可使用低速手机搅动，一定要小心避免将材料溅起。此混合物可能起泡，牙体的颜色也会逐渐改变。通常此技术仅使用一次不会成功，可能需要重复好几次，但一般打磨半小时之后会显效。过去，每次复诊之后都用浮石粉抛光，现在已经证实没有必要。

- 每次打磨之后，使用大容量吸引器，将酸仔细的冲洗干净。确保患者、医师和护士都有眼罩保护。
- 重复以上步骤，直到医师和患者对牙体的最终颜色达成一致。
- 注意，治疗结束后可能见到釉质中有浅的凹陷，这是酸蚀剂对釉质作用的结果。
- 如果有必要，可用颜色适当的复合树脂将该凹陷充填起来。
- 治疗结束后，不要涂氟化物，因为牙齿会很快再水化。患者应至少在治疗后的1周内戒烟并避免进食那些可能导致着色的食物，如咖喱、茶、咖啡。

flat plastic spatula and gradually agitate the material with a rubber cup. A speed-reducing handpiece can be used and care must be taken to avoid splattering of the material. The mixture effervesces and the colour of the tooth gradually changes. The technique is not usually successful after one application and may need repeated applications, but success is normally achieved in one half-hour appointment. Previously the tooth was pumiced between applications but this has been shown to be unnecessary.

- Wash the acid carefully away after each application under high volume aspiration—ensuring patient, nurse and clinician have eye protection.
- Continue the process until patient and clinician agree on the final colour.
- Note that a shallow depression is usually visible within the enamel after treatment has been completed. This is the result of the enamel removed by the acid.
- Fill the depression with an appropriately shaded resin composite, if required.
- Do not apply a fluoride varnish after treatment as the tooth quickly rehydrates. The patient should, however, avoid smoking and consuming those foods likely to cause stains—for

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临床医师们可能会发现很难买到浓盐酸，因此，许多临床医师推荐使用釉质切割技术。尽管这种技术在原理上类似于微打磨，但它更加安全且在牙科临床上可能更容易被接受。它对氟斑牙患者很有效，因其可去除局部的着色，而对于更广泛的着色牙，活髓漂白术会更适合。

釉质切割术的步骤如下：

- 用高速水冷却的碳化钨钻去除着色的釉质表层（不用橡皮障），要特别注意不要去除过度。
- 重复上述步骤，直到达到预期的牙体颜色。如果切割或预备未达牙本质，通常不需要修复。釉质上若有明显的凹陷，则需要用复合树脂充填。不需要充填的要使用氟化物凝胶处理。
- 如果牙本质暴露或牙体出现敏感症状，则应局部应用复合树脂修复。

example, curry, tea, coffee—for at least the first week following treatment.

Practitioners can find purchasing concentrated hydrochloric acid difficult. For this reason many clinicians suggest an enamel biopsy technique. The enamel biopsy technique, although similar in principle to microabrasion, is safer and more likely to achieve acceptance in general dental practice. In patients with fluorosis this technique can be helpful, as it removes localized stains, whereas for more generalised stains a vital bleaching technique would be more appropriate.

An enamel biopsy technique is carried out as follows:

- Remove (without rubber dam) the stained enamel surface with a high-speed water-cooled tungsten-carbide bur, with particular care being taken not to be overly destructive.
- Continue the process until the desired colour change has been achieved. Provided the biopsy or preparation does not involve dentine, a restoration is not usually required. Significant depressions in enamel will require restoration with resin composite. If a restoration is not placed it is helpful to apply a fluoride gel.
- Use a small localised resin composite restoration if dentine is exposed or the tooth becomes sensitive.

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拓展阅读

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第4章 复合树脂薄层技术

Laminate Resin Composite Techniques

目　的

本章的目的在于讨论如何应用复合树脂薄层技术制作前牙的美容修复体。

要　点

通过本章使从业医师熟悉用于改善前牙外观的薄层复合树脂修复体所用的最佳材料和技术。

引　言

从牙本质粘结系统到复合树脂粘结系统的不断发展，使复合树脂的应用范围得到了广泛的拓展，它已经能够成功地用于前牙大面积缺损的修复。牙本质粘结剂以及复合树脂与牙釉质、牙本质的良好结合，使机械备牙变得多余。许多前牙修复体只需要去除龋坏组织，并保持牙面清洁干燥就可以获得最大粘结力，这对于患者来说是相当有益的，因为不需要进一步磨除

Aim

The aim of this chapter is to consider how laminate resin composite techniques can be used to provide aesthetic restorations for anterior teeth.

Outcome

On reading this chapter practitioners will become familiar with the materials and techniques best suited to improve the appearance of anterior teeth with laminate resin composite restorations.

Introduction

Resin composites have developed in tandem with dentine adhesive systems to the extent that resin composite adhesive systems can be used effectively to restore extensive defects in anterior teeth. Linking dentine-bonding agents and resin composites to enamel and dentine frequently removes the need for mechanical preparation. Caries removal and ensuring that the surface is clean and dry to maximise bond

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已经损坏的前牙牙体，而且不必送到技工室去制作间接修复体。

strength is all that is required for the restoration of many anterior teeth. This has considerable advantages for patients in that already damaged anterior teeth can be restored without further tooth preparation or the use of a laboratory to produce indirect restorations.

目前的复合树脂含有透明的釉质色和牙本质色，有些厂商还提供很少用到的遮色或漂白牙的颜色。复合树脂的塑型方法与烤瓷冠在技工室的塑型方法一样（也是先堆核，再堆牙本质、牙釉质层）。使用这类材料的修复技术与其他直接修复技术大同小异，只有一点不同，那就是大多数直接修复技术只使用牙本质色，几乎不使用牙釉质色。常见的错误是过多使用牙釉质色或透明色，以至于修复体显得过灰或过蓝。

Current resin composites contain translucent enamel and dentine shades. Some manufacturers also provide opaquing or bleaching tooth shades, which are rarely needed. The resin composites are built up in a similar manner to making a porcelain crown in the laboratory (using core, dentine and enamel shades). The technique for these materials is not dissimilar to other direct build-up techniques, except that the majority of the build-up is done with dentine shades, with very little enamel shade used. A common mistake is to use too much of the enamel shades or the translucent shades, which can give a restoration that is very grey or blue.

直接复合树脂修复的优点

Advantages of Directly Placed Resin Composites

瓷贴面修复技术的优点是牙体预备量少。这种技术的局限性（特别在尖牙）是，在与就位道有关的基牙牙体预备过程中可能产生倒凹。如果预备量过少，过于突起的尖牙的近远中面都会存在倒凹。另有一些临床医师提倡多磨一些牙体组织，为瓷层提供空间

The advantage of most porcelain laminate veneer techniques is minimal tooth preparation. The one limitation of this concept (especially on canines) is the potential to produce undercuts during tooth preparation relative to the path of insertion. Very bulbous canines, if minimally

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并去掉倒凹，但是这样做将削弱此项技术破坏性小的优势。复合树脂可用于所需的地方，而一般不需要牙体预备（图 4-1）。

直接复合树脂贴面的另一个优点是修复体在使用一段时间后能重新修补及磨光。小的裂纹、局部着色或龋坏可以去掉，或用复合树脂和牙本质粘结剂来修复。当新旧复合树脂粘结时，硅烷粘结剂可以提高两层修复材料之间的粘结力。崩瓷可以用复合树脂来修补，但看上去不完全一样。瓷层、牙齿与复合树脂之间不可能获得粘结力，除非应用氢氟酸酸蚀。

prepared, will have an undercut between the mesial and the distal surfaces. Alternatively, some clinicians advocate removing more tooth tissue to create space for porcelain and to remove the undercut, but that reduces the advantage of the technique being minimally invasive. Resin composite can be placed where it is needed and generally without tooth preparation (Fig 4-1).

Another advantage of direct resin composite veneers is the capacity to repair and refurbish the restoration over time. Minor fractures or localised staining or caries can be either removed or repaired with a resin composite used in conjunction with a dentine-bonding agent. It is useful when bonding old to new resin composite to use a silane-bonding agent to improve the bond between the two increments of material. Porcelain fractures can be repaired with

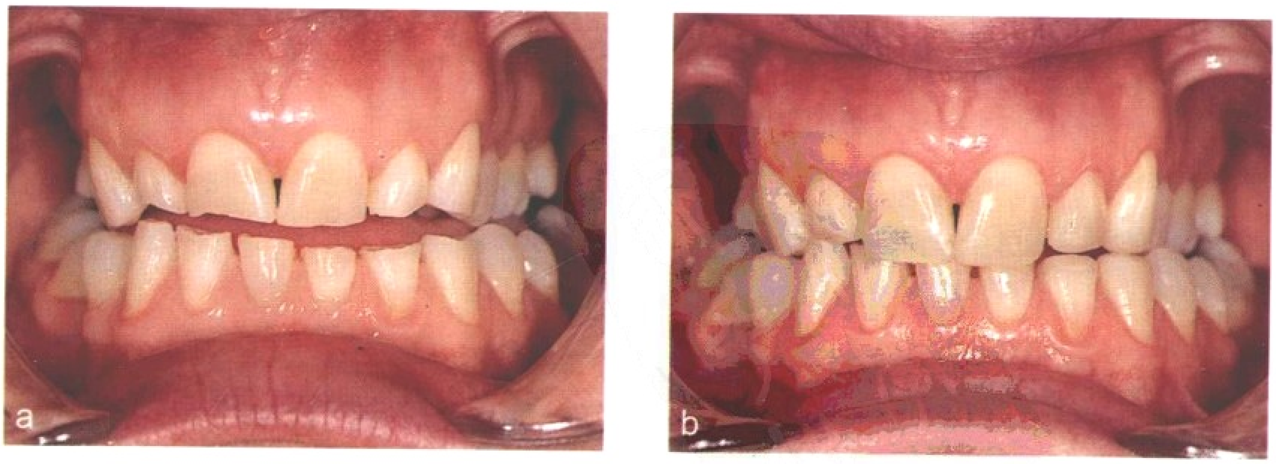


图 4-1　a. 处于后退接触位（RCP）时患者的牙齿磨损情况；b. 复合树脂修复前牙，稳定了患者的后退接触位

Fig 4-1 (a) Tooth wear with the patient in the retruded contact position (RCP). (b)Resin composite placed to restore the anterior teeth and stabilise the patient's RCP.

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resin composite but never look quite the same and, unless hydrofluoric acid is used, it is unlikely that a bond between the porcelain and the tooth or resin composite luting cement will be achieved.

直接复合树脂修复体的另一个显著优势在于，相比适合做瓷贴面的老年患者，此技术对年轻人（青少年）大有裨益。同样地，直接树脂贴面修复术适用于牙龈发育未成熟者。

Directly placed resin composite laminate restorations have another significant advantage in that the technique is very good for young (adolescent) patients not of an age to justify porcelain laminate veneers. Equally, directly placed resin composite laminate restorations are to be preferred when gingival maturation is not complete.

直接复合树脂修复的缺点

Disadvantages of Directly Placed Resin Composites

直接复合树脂修复最显著的缺点可能是，要达到美观效果需要花费一定的临床操作时间。虽然瓷贴面还涉及技工室操作以及相关的其他费用，但是所有这些操作，如成形、塑形及染色都是由技师来完成的，临床医师只需要将修复体粘结就位即可。对一些临床医师而言，直接用复合树脂贴面修复也能够获得满意的临床效果，但很具有挑战性；而另一些医师认为这是在浪费时间，他们更喜欢寻求技师的帮助。

Probably the most significant disadvantage with directly placed resin composites is the clinical time needed to produce an aesthetic result. Even though porcelain veneers involve a laboratory phase and consequently additional cost, it is the technician who spends the time shaping, contouring and colouring the restoration. The clinician need only lute the restoration into place. For some clinicians, the concept of a directly placed resin composite veneer is challenging and clinically satisfying, while for others this time is not well spent and they prefer the support of a technician.

直到现在，直接复合树脂贴面在颜色上仍存在缺乏深度和变化的缺点。微填料复合树脂在很大程度上克服了

Until recently, directly placed resin composite veneers lacked depth or variation in colour. Microhybrid resin composites over-

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这一缺点，但是为达到良好修复效果，使用此材料需要的临床操作时间却显著增加。较透明的釉质色用于切端可以达到令人满意的效果，但是，若使用过多或不加选择地使用，则会适得其反（图 4-2）。读者最好参阅拓展阅读部分中关于如何选择复合树脂的建议。

临床技术

中、小型修复体

大部分情况下，复合树脂可直接用于修复前牙（图 4-3）。没有证据显示此技术需要常规应用垫底材料，因为垫底会大大减少粘结面积。牙本质粘结剂不仅可用于牙本质和釉质的粘结，还可通过封闭修复体与牙的界面以减少微渗漏。因此，根本不需要通过垫底来保护牙髓不受进一步伤害。

come this to a large extent, but the clinical time needed to place these materials to good effect has increased significantly. More translucent enamel shade on the incisal tips can produce very acceptable results but can produce unacceptable ones if too much is used or they are used indiscriminately (Fig 4-2). Readers are referred to the Further Reading section for advice on selection of resin composites.

Clinical Techniques

Small and Moderately Sized Restorations

For the most part, using resin composites to restore anterior teeth is straightforward (Fig 4-3). There is little evidence to support the routine use of lining materials particularly as they effectively reduce the area available for bonding. The dentine-bonding agent will not only bond to the dentine and the enamel but also reduce the potential for microleakage by sealing the restoration tooth interface. Therefore, there



图4-2　修复右上中切牙切端的复合树脂过于透明

Fig 4-2　Excessive translucent resin composite has been placed to restore the incisal edge of tooth 11.

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图 4-3 a. 龋坏且牙体磨损的牙齿适合直接复合树脂修复；b. 由于牙体磨损，导致切端过于透明，前面观欠美观；c. 剪开橡皮障进行隔离；d. 治疗后（前面观）；e. 治疗后（腭面观）

Fig 4-3 (a) Teeth suitable for direct build-up with resin composite featuring caries and tooth wear. (b) Unaesthetic anterior view due to tooth wear, resulting in translucent incisal edges. (c) Split rubber-dam isolation. (d) Completed treatment (anterior view). (e) Completed treatment (palatal view).

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很多厂家生产了一系列以 Vita 体系为基础（Vita Zahnfabrik，Bad Säckingen，Germany）研发的牙釉质和牙本质的遮色剂或各种颜色的复合树脂。这使临床医师有机会用树脂来修复缺损牙。用牙本质色修复缺失的牙体组织，用釉质色修复表面透明层。这些釉质色十分透明，应慎重使用，以免使用过量，否则修复体会显得过于透明或“发蓝”。在牙齿重新塑形时，使用这种遮色树脂意味着不能在临床上采用先过度塑形然后去掉多余部分材料再抛光的技术。牙齿的形状及大小应大致成形，再对形状做小范围的调整，最后抛光。使用了遮色树脂再过度恢复牙齿的外形，可能导致成形抛光后失去透明层。

临床步骤

- 牙体预备，如有龋坏，要去净全部龋坏组织。
- 如果存在近髓的龋坏应小心去除。没有证据表明必须去掉所有近髓的龋坏。必须确定牙本质是坚硬的，因为软化的牙本质一旦

is little need for a lining to protect the pulp from future damage.

Many manufacturers produce a series of enamel and dentine opacities or shades, usually based on the Vita system (Vita Zahnfabrik, Bad Säckingen, Germany). They effectively allow the clinician the opportunity to rebuild the broken-down tooth. The dentine shades replace the bulk of missing tooth tissue while the enamel replaces the more translucent surfaces. Some of these enamel shades are very translucent, and care should be taken not to over-use them, otherwise the restoration will appear too translucent or “blue”. The use of these different opacities to rebuild the tooth means that the clinical technique of overbuilding the tooth to cut it down and then polish is not possible. The approximate shape and size of the tooth should be rebuilt, leaving only minor changes to the shape and a final polish. Overbuilding with the different opacities may result in the translucent shades being removed during the shaping and polishing stages.

Clinical Stages

- Prepare the tooth and remove peripheral caries, if present.
- Remove carefully pulpal caries, if present. There is little evidence that removing all the pulpal caries is necessary. Firm dentine is, however, re-

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封闭就会变得越来越硬、越来越干，随后崩解，在修复体下面形成空腔，此外，现代粘结系统在软化牙本质上的使用效果也值得怀疑。在大多数情况下，只要近髓的龋坏组织够硬，封闭良好的修复体就能阻止病损的进一步发展。

quired because soft dentine once sealed becomes harder and dryer and collapses, leaving a void under the restoration. In addition, the performance of modern adhesive systems on softened dentine is questionable. In most cases, provided the pulpal caries is reasonably hard, a well-sealed restoration will prevent further progress of the lesion.

- 确保隔湿良好。最好使用橡皮障或小心地使用棉卷及吸唾器。不管用哪种方法都必须保护预备的牙体不受污染。

- Ensure adequate moisture control. This can best be achieved with a rubber dam or judicious use of cotton wool rolls and salivary ejectors. Either way, it is essential to protect the preparation from contamination.

- 根据牙本质粘结剂的类型采用不同的使用方法，有的先酸蚀10 s，或先涂一层底胶。然后在牙面上涂第二层底胶或粘结剂，并根据材料类型在牙面涂激活剂 20～30 s。

- Depending on the type of dentine-bonding agent used, either etch for 10 seconds or apply the first coat of the primer. Apply the second coat or the bonding agent to the tooth surface and agitate the material over the surface of the tooth for between 20–30 seconds, depending on the material.

- 在牙面添加合适的复合树脂，并根据厂家的使用指南进行光照固化。

- Place the preferred resin composite in increments and light cure according to the manufacturer's directions for use.

- 用碳化钨钻或抛光金刚砂钻去掉多余的复合树脂。按照邻牙的表面轮廓修整修复体的外形。若边缘接触到牙龈组织，应确保钻尖在修复体与牙龈间的角度正确。

- Trim back any excess resin composite with a tungsten-carbide bur or a polishing diamond. Copy the surface contours of adjacent teeth to produce the shape of the restoration. If the margin approaches the gingival tissues posi-

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tion the bur to achieve the correct emergence angle between the restoration and the gingival tissues.

- 用磨盘、橡皮杯或火焰状精修钻对复合树脂进行抛光。
- 用金刚砂抛光膏做最后的表面抛光。

- Polish the resin composite with abrasive discs, rubber cups or flame-shaped finishing burs.
- Use a diamond polishing paste to achieve the final finished surface.

改变牙齿形状和大小

牙体磨损或重塑牙齿外形时，如关闭中切牙缝隙，需要大面积的树脂修复。这就需要另一种技术去恢复和保持牙齿的外形和颜色（图 4-4）。聚乙烯硅氧烷阴模对大面积修复体的重塑特别有用。这种阴模可以通过给原来牙齿取印模来获得，不能获得原来牙齿的完整外形时，可以从诊断蜡型上获得。这种方法对牙齿已经严重磨损，失去了其基本形状的患者十分有用。用上述阴模复制诊断蜡型，然后用于复合树脂的重塑。

Changes to Shape and Size of Teeth

More extensive restorations as a result of either tooth wear or reshaping teeth–for example, closing diastemas–require different skills for building and maintaining the shape and colour of the tooth (Fig 4-4). Polyvinyl siloxane matrices can be particularly useful for rebuilding extensive restorations. These can be produced by taking an impression of the original tooth shape or, when this is not possible, from a diagnostic wax-up. This is useful in patients with tooth wear where the basic shape of





图 4-4　a. 中切牙间缝隙大，欠美观；b. 用复合树脂修复后

Fig 4-4　(a) Patient with diastemas and poor aesthetics. (b) Restoration with resin composite.

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the tooth has been worn away. The diagnostic wax-up is replicated by the matrix which is then used to support the build-up of resin composite.

抛 光

有很多技术可供使用，包括利用磨盘和（或）旋转抛光设备（图4-5）。没有证据表明其中的某种技术优于其他技术。大部分技术的选择是基于临床医师的个人喜好。无论喜欢哪一种技术，一般都要使用打磨的磨料，并结合使用金刚砂抛光膏精修完成。从抛光盘到抛光杯以及钻，这些形状各异的抛光工具都十分有效（图4-6）。碳化钨和金刚砂抛光钻都是特别有用的，因为在使用打磨作用较弱的抛光盘或抛光杯之前，使用磨光作用较强的钻可帮助修复体成形。

Polishing

There are numerous techniques available, which include using discs and/or rotary polishing devices (Fig 4-5). There is little evidence that any technique is superior and much depends on the personal choice of the practitioner. Whatever technique is preferred, it is normal to use a reducing range of abrasives coupled with final finishing with a diamond polishing paste. There is a variety of shapes, from discs to cups and burs, all of which produce an effective result (Fig 4-6). Tungsten- carbide and diamond polishing points are particularly useful, as more abrasive ones can help shape the restoration before using the less



图 4-5 复合树脂精修钻

Fig 4-5 Resin composite finishing points.



图 4-6 复合树脂的精修及抛光系统

Fig 4-6 Finishing and polishing systems for resin composite.

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abrasive polishing discs or cups.

临床步骤

• 设计修复体的形状及颜色，可能用到诊断蜡型。

• 若采用了诊断蜡型，可用聚乙烯硅氧烷阴模来复制修复体外形。

• 牙体预备。一些临床医师常用小斜面改善外观及提高粘结力，但是没有临床证据支持这一步骤。因此，是否这样做完全取决于临床判断。预备的范围必须根据病例的特殊需要而定（从完全不做预备到做类似于瓷贴面的预备均可）。

• 若临床医师可以做到完全隔湿的话，不一定要使用橡皮障。但是，若无法隔离潮湿和污染，就必须应用橡皮障。

• 根据说明书使用牙本质粘结剂。

• 若使用聚乙烯硅氧烷阴模，应把它放在邻牙的腭面上。

• 用复合树脂逐层形成修复体的体部。通常是用牙本质色树脂来完成。为解决材料聚合时的收缩问题需要采用逐层成形法。但是

Clinical Stages

• Plan the shape and colour of the restoration, possibly with a diagnostic wax-up.

• If using a diagnostic wax-up, copy the shape of the restorations with a polyvinyl siloxane matrix.

• Prepare the teeth. Some clinicians use bevels to improve the appearance and the bond. There is no clinical evidence to justify this step, so the decision whether or not to do so relies on clinical judgement. Essentially, a range of preparations (from virtually nothing to preparation similar to that required for a porcelain laminate veneer) will be required, depending on the specific needs of the case.

• Provided the clinician can achieve adequate moisture control, rubber dam need not be used. However, if moisture contamination cannot be avoided then rubber dam is essential.

• Apply the dentine-bonding agent according to the directions for use.

• If using a matrix, position it onto the palatal surfaces of the adjacent teeth.

• Incrementally build up the body of the restoration in resin composite. This is usually achieved with dentine shades. The incremental build-up is needed to

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分层不需要过多，一般3～4层足以，这完全取决于牙体预备量的多少。

overcome the polymerisation contraction of the material. This need not involve too many increments, normally three to four per restoration is sufficient, but will depend on the size of the preparation.

- 用塑形钻或抛光盘去掉多余的材料并修整塑形。
- 用精修钻精修。
- 最后，用金刚砂抛光膏进行抛光。

- Trim back and shape the excess with shaping burs or abrasive discs.
- Polish the restoration with finishing burs.
- Finally, polish the restoration with diamond polishing pastes.

拓展阅读
Further Reading

Wilson NHF, Wilson MA. Indirect composite veneers. In: 1989 Dental Annual, Derrick Dentistry (ed). Guildford: Butterworth Scientific, 1989:268–272

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第 5 章 瓷贴面技术

Porcelain Laminate Techniques

目 的

瓷贴面修复技术与更传统的全冠修复技术相比，可能因为其修复效果不如后者理想，从业医师并未广泛采用。本章旨在深入探讨瓷贴面修复技术，并思考如何使之在现代美容牙科学上达到良好的修复效果，以及与全冠修复相比瓷贴面的优势所在。

要 点

阅读本章后，临床医师将熟悉瓷贴面技术的适应证、禁忌证和优缺点，以及如何使用这种修复体取得最佳临床效果。

Aim

Porcelain laminate veneer techniques have not been popular with certain practitioners, possibly because they have given poor results in comparison with those obtained by more traditional full-coverage techniques. The aim of this chapter is to reconsider porcelain laminate veneer restorations and consider how they can be used to good effect in modern-day aesthetic dentistry. The advantages of porcelain laminate veneers when compared to fullcoverage techniques are also considered.

Outcome

On reading this chapter practitioners will be familiar with the indications, contraindications, advantages and disadvantages of porcelain laminate veneers along with the clinical techniques necessary to achieve optimal results with restorations of this type.

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引　言

酸蚀技术最早是由Michael Buonocore于1955年首先提出的。1973年Rochette发现这种技术有与树脂基材进行微机械结合的潜力，并将此技术用于下颌前牙的牙周夹板治疗中。十多年后，人们同时提出了瓷酸蚀和硅烷偶联剂两种技术。这两种新技术联合使用，使得现代临床医师能够预测树脂粘结修复体的修复效果。从而使这类修复体能够粘结就位，为微创修复体（如瓷贴面）提供更广阔的使用空间。

Introduction

The acid-etch technique was first described by Michael Buonocore in 1955. Rochette realised the potential of this for the micromechanical attachment of resin-based materials in 1973 and used the technique for the splinting of periodontally involved lower anterior teeth. Some ten years later porcelain-etching and the use of silane-coupling agents were concurrently described. The combined effects of these innovations have been that predictable outcomes for resin-bonded restorations are now possible for practitioners. These restorations can be bonded into place, which opens up opportunities for minimally interventive restorations (for example, porcelain laminate veneers).

历史回顾

Charles Pincus博士于1984年首先提出了Hollywood贴面。他利用此技术为男女演员改善牙齿的外观，如著名演员Shirley Temple。贴面用义齿粘结剂粘结就位，并在拍片结束后去掉。过去曾尝试用中空的丙烯酸塑料牙做实验，结果发现丙烯酸和复合树脂的粘结效果很差。同样，在20世纪80年代，以Caulk为代表的丙烯酸塑料贴面，也因丙烯酸和复合树脂之间的粘结力不佳而以失败告终。微精复合树脂也曾被使用过，但也因耐磨性差，聚合收缩

Historical Perspective

Dr Charles Pincus first described Hollywood veneers in 1948. He used the technique to improve the appearance of teeth for actors and actresses, notably Shirley Temple. The veneers were held in place with denture adhesive and were removed after filming. Hollowed-out acrylic denture teeth, which failed, given a poor bond between the acrylic and resin composite, have been tried in the past. Similarly, preformed acrylic veneers marketed by Caulk in the 1980s tended to fail as a consequence of a

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大以及色素沉着影响美观而宣告失败。瓷贴面技术是1983年首次提出，并于1984年传入英国的。虽然已有一些瓷材料供我们选择，但我们也要认识到，直接和间接复合树脂贴面技术作为过渡性修复治疗，在青少年患者中仍占有一席之地。

poor bond between the acrylic and luting resin composite. Microfine resin composites have also been used, but these failed due to poor wear resistance, polymerisation shrinkage and inferior aesthetics with stain build-up. Porcelain veneers were first described in 1983 and introduced into the UK in 1984. Although porcelain is the material of choice, it should be noted that direct and indirect resin composite veneering techniques still have a place in the treatment of adolescent patients as intermediate restorations.

适应证

瓷贴面适用于以下几种情况：

- 治疗表面不美观的健康前牙。
- 修正前牙的颜色、外形、长度、排列。
- 修复折断的或经根管治疗过的前牙。
- 治疗釉质发育不全的前牙。
- 遮盖由创伤、根管治疗、氟斑牙、四环素牙引起的牙齿变色（图5-1）。
- 修补前牙损伤，如切端的折断。
- 遮盖牙齿异常的解剖外形，如锥形侧切牙（图 5-2）。
- 治疗釉质发育不全，而不是牙本

Indications

Porcelain laminate veneers are thought to be indicated in the following situations:

- Treatment of unsightly surface defects in essentially sound anterior teeth.
- Modifications to anterior tooth colour, shape, length and alignment.
- Restoration of fractured and endodontically treated anterior teeth.
- Treatment of anterior teeth with hypoplastic enamel.
- Masking discoloration caused by trauma, endodontic treatment, fluorosis and tetracycline staining (Fig 5-1).
- Repair of damage to anterior teeth, such as fractured incisal edges.
- Masking anatomical anomalies, including peg-shaped laterals (Fig 5-2).
- Treatment of amelogenesis imperfecta

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图 5-1 a. 四环素着色；b. 同一患者经瓷贴面修复后

Fig 5-1 (a) Tetracycline staining. (b) Same patient with porcelain laminate veneers.

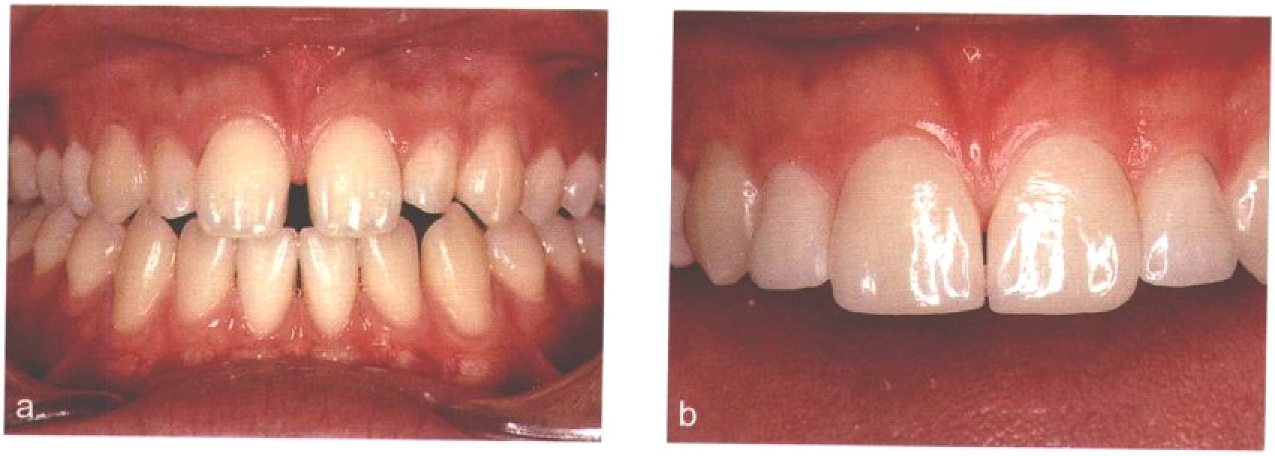


图 5-2 a. 患者中缝过宽且伴有侧切牙形态异常；b. 同一患者经瓷贴面修复后

Fig 5-2 (a) Patient with a diastema and abnormally shaped lateral incisors. (b) Same patient with veneers in place.

质发育不全。因为在牙本质发育不全时，牙釉质容易折裂导致修复体早期失败。

- 关闭中缝，虽然对于某些细心选择的病例，用直接复合树脂修复法也能够很容易达到目的。

禁忌证

相反，以下临床情况是瓷贴面修

but not dentinogenesis imperfecta, as the enamel is prone to fracture off in the latter condition, leading to early failure of the restorations.

- Closure of a median diastema, although this can be achieved quite easily with direct application of resin composite in carefully selected cases.

Contraindications

In contrast, porcelain laminate veneers

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复的禁忌证：

- 口腔卫生状况差。
- 修复体边缘不得不放在龈下过深的位置。
- 异常殆力，如夜磨牙症。
- 没有足够的牙体组织提供粘结，或者即使牙釉数量够，但质量差。
- 患牙上有大量修复体存在时适合全冠修复，有报道称，在有修复体的患牙上做瓷贴面修复失败率高。

are contraindicated in the following clinical situations:

- Poor oral hygiene.
- Where the restoration would have to have deeply placed subgingival margins.
- Atypical occlusal loading (for example, bruxism).
- Lack of adequate amounts of tooth tissue for bonding or poor-quality enamel, albeit in adequate amounts.
- Presence of large existing restorations, which favour a full coverage technique, as failure rates for porcelain laminate veneers placed on teeth with existing restorations are reported to be high.

优　点

通常认为瓷贴面修复有以下的优点：

- 与全冠修复相比，对牙体破坏少。
- 牙体预备和粘结贴面时一般不需要局部麻醉。
- 美观效果相当好。
- 不需要制作临时修复体。

Advantages

It is generally accepted that porcelain laminate veneers have the following advantages:

- Minimally interventive, especially when compared with full coverage restorations.
- Local analgesia is not normally required for tooth preparation or placement of the veneers.
- The aesthetic outcome can be exceptional.
- Typically no provisional restoration(s) are required.

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缺 点

- 这种技术是不可逆的。过去认为这种技术是可逆的，部分原因是对牙体预备的本质认识不够造成的。
- 应用范围相对狭窄，要求牙体基本完好。
- 技术要求高，特别是牙体预备的要求以及粘结时湿度的控制。
- 长期临床资料不多但结果令人鼓舞，瓷贴面使用3年以上是合理的，但是根据临床经验，贴面的临床使用寿命可以超过5～10年。
- 修复体边缘容易碎裂和着色，特别是有粘结剂暴露时。

做牙体预备还是不做牙体预备?

瓷贴面最初传到英国时，是不建议做牙体预备的。这是因为临床医师不知道瓷贴面能使用多久，如果贴面脱落，牙齿还可以回到原来的状态。因此，当时人们认为这个技术是可逆的。这带来了两种后果：①因为没有牙体预备，贴面的早期固位率很低；②临床研究发现被修复牙侧面外形不佳，近瓷贴面处常发生龈缘炎（图5-3）。有

Disadvantages

- Not a reversible technique, although previously thought to be, which is partly responsible for the confusion regarding the nature of preparation required.
- Relatively limited application, given that the tooth or teeth should be essentially intact.
- Technique sensitivity, in particular demanding preparation criteria and moisture control at placement.
- Long-term data are somewhat limited but encouraging–porcelain laminate veneers can reasonably be expected to last at least three years but clinical experience suggests that clinical service is typically in excess of five to 10 years.
- Possibility of marginal chipping and staining, especially if lute is exposed.

To Prepare or Not to Prepare?

When porcelain laminate veneers were first introduced into the UK, tooth preparation was not recommended. This was because practitioners were not sure how long porcelain laminate veneers would last and if they fell off the tooth would be back to square one. As a consequence, the technique was thought to be reversible. This had two effects: early retention rates were low

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图5-3 a. 未做牙体预备的瓷贴面修复，这是一幅行牙龈切除术去除边缘发炎的牙龈组织后的图片。b. 殆面观显示由于未做牙体预备，因而瓷贴面显得特别突出。c. 患者用新的瓷贴面修复。请注意黑三角区，这是必要的，因为它可以使牙齿显得稍长一些。d. 从殆面观，瓷贴面没有显得那么突出，更接近解剖外形

Fig 5-3 (a) Porcelain laminate veneers placed without preparation. This view is after a gingivectomy needed to remove the marginally inflamed gingival tissue. (b) Occlusal view showing how the veneers are bulky due to underpreparation. (c) Patient with new veneers. Note the black triangle and that of necessity the teeth are somewhat long. (d) Occlusal view showing how the veneers are less bulky and more anatomical.

统计显示，未做牙体预备的瓷贴面会增加牙周炎的发生率（图 5-4）。

because no tooth preparation had been carried out, and the effect on the emergence profile of the restored teeth was adverse, with marginal gingivitis adjacent to porcelain laminate veneers a common clinical finding (Fig 5-3). It has been shown that veneers placed without tooth preparation lead to an increase in associated periodon-

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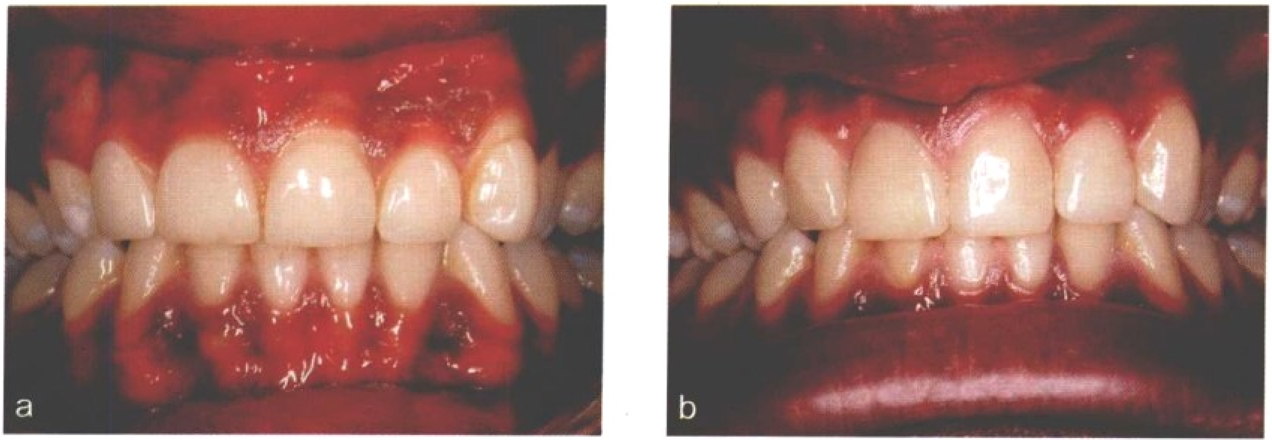


图5-4 a. 瓷贴面置于牙龈组织未发育成熟的十几岁的青少年口中，未做牙体预备，贴面也显得过于突出；b. 患者用新的贴面修复后。请注意右上第一前磨牙做成了缺失的右上尖牙的形状

Fig 5-4 (a) Porcelain veneers placed in the patient's early teens prior to gingival maturation. The veneers have also been placed without preparation and are bulky. (b) Patient with new veneers. Note that tooth 14 has been disguised to look like tooth 13, which is missing.

研究显示，牙体预备是有必要的，其优点包括：

- 与不做牙体预备相比，瓷贴面与釉质的粘结力显著增高。
- 修复体侧面外形改变极小，因此，牙龈反应相当好。
- 牙齿外观尺寸的增加非常小。提高了外形的美观效果，患者也更容易接受。

牙体预备

瓷贴面的牙体预备可分为以下几

tal problems (Fig 5-4).

Research has demonstrated that tooth preparation is therefore indicated. The advantages of tooth preparation are considered to include:

- Marked increase in bond strength to enamel when compared with nonpreparation.
- Minimal effect on the emergence profile of the restored unit and, as a consequence, opportunity for excellent gingival response.
- Minimal, if any, increase in the overall dimensions of the tooth, facilitating an excellent aesthetic outcome and patient acceptance.

Tooth Preparation

Tooth preparation for porcelain laminate

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个步骤：

- 一般情况下不需要局部麻醉，牙体预备完全在釉质层中进行。但是，事实上很难做到这一点，在牙体预备过程中不可避免地会有牙颈部的牙本质暴露。这通常不成问题，因为一般病人很少感觉不适。但是这样做，却意味着在粘结时必须使用牙本质粘结系统。

- 建议均匀磨除唇面牙体组织0.3～0.5 mm（变色牙可磨除更深一点，但面积不超过患牙）。研究表明控制牙体预备的深度，最好使用有深度的钻或者聚乙烯硅氧烷阴模引导制备。

- 牙体预备中，重要的是要重建牙齿的天然解剖外形。一般情况下，切牙有两到三个平面，尖牙有三个或三个以上的平面。因此，在预备过程中应考虑到这一点，将钻与牙面形成一定角度。图5-5是目前使用的特殊的牙体预备套装。

- 建议将肩台置于颈缘，并尽可能使用龈上肩台。龈下（>0.5 mm）肩台一般不用于瓷贴面。这种情况用传统的粘结技术

veneers can be broken down into the following stages:

- Typically, no local anaesthesia is required; prepare the tooth entirely within enamel. This is, however, very difficult; inevitably dentine will be exposed cervically during tooth preparation. This is not usually a problem in that patients rarely feel any discomfort. It does, however, mean that during luting procedures the use of a dentine-adhesive system is essential.
- A uniform labial reduction of 0.3 to 0.5mm (deeper in discoloured teeth and areas within individual teeth) is recommended. Studies have shown that depth of preparation is best controlled by using a depth gauge bur or a polyvinyl siloxane index.
- During tooth preparation it is important to reproduce the natural anatomical planes of the tooth. Typically, there are two to three planes in incisors and three or more planes in canines. Consequently, the bur should be angled to take account of this during tooth preparation. Special preparation kits are available (Fig 5-5).
- Chamfered juxtagingival or, wherever possible, supragingival cervical margins are recommended. Subgingival (> 0.5mm) margins may be considered to

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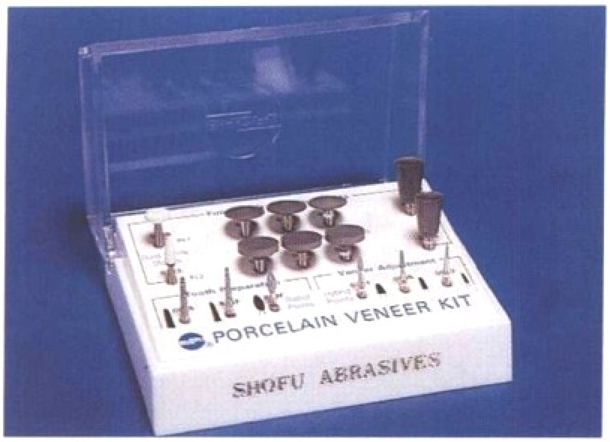


图 5-5 贴面牙体预备套装

Fig 5-5 Veneer preparation kit.

进行全冠修复可能会取得更好的临床效果。

preclude the prescription of porcelain laminate veneers. In such cases a full-coverage restoration placed using a conventional luting technique may give the most favourable clinical outcome.

- 牙体预备扩展到邻面但又不越过邻接点。有些人主张牙体预备超过邻接区，特别是邻面区已有修复体存在时。但是，如果因为现存的修复体不能将牙体预备扩展到牙/瓷界面，那么就不能用瓷贴面修复。

- Extend the preparation into but not through the proximal contacts. Some advocate preparing through the contact area–in particular, in areas where there are existing proximal restorations. If extension of the preparation to give a tooth/ceramic interface is not possible because of an existing restoration, a porcelain laminate veneer may be contraindicated.

- 通常建议将切嵴磨除 1 mm 并将舌腭侧制成小斜面（图 5-6）。但最近的研究显示，瓷贴面放在羽状切嵴的牙体上，与将牙磨除 1 mm 并预备切斜面的使用寿命一样长，因此，建议在经过挑选的病例中，可以考虑预备体使用羽状切嵴。

- It is generally recommended that the incisal edge be reduced by 1mm and bevelled on the lingual or palatal surface (Fig 5-6). Recent studies have suggested, however, that porcelain laminate veneers placed with a feathered incisal edge have equivalent longevity to teeth reduced by 1mm to give

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图 5-6 a. 贴面修复牙体预备；b. 患者贴面修复后

Fig 5-6 (a) Veneer preparations. (b) Patient with veneers placed.

a bevelled incisal edge. It is suggested therefore that consideration be given to preparing a feathered incisal edge in selected cases.

- 若需要增加牙冠长度，建议在预备体的舌腭斜面上叠加贴面。

- Overlapping, i.e. taking the preparation onto the lingual or palatal surface beyond the bevel, is recommended if the overall length of the tooth is being increased.

- 开窗式预备现在已不推荐采用了，这最早是为尖牙设计的预备方式，它可以避免改变由腭面和切牙牙尖构成的尖牙导面，这是因为，重建一个完美的切缘是很困难的。但做了开窗式预备后牙釉质很容易折裂。

- Window preparations, which were originally recommended for canines to avoid altering canine guidance provided by the palatal surface and incisal tip, are no longer recommended. This is because it is difficult to create a perfect incisal margin and there is a high risk of enamel fracture with window preparations.

- 最后，预备体要用精细的高速水冷却的金刚砂钻磨平。各个线角必须圆钝。

- Finally, the preparation is smoothed with fine-grade high-speed, water-cooled, diamond finishing burs. Any sharp line angles must be rounded.

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钻的选择

在牙体预备的粗磨和细磨阶段应选用不同的钻，多家钻的生产商为此生产了专用钻，还包括一些相匹配的精修钻。

Bur Selection

In terms of the burs to use for the gross and fine stages of tooth preparation, several of the bur manufactures have produced specific bur selections for this purpose, which frequently include matched finishing burs.

其他临床步骤

通常不需要使用排龈线退缩牙龈，因为理想的肩台最好位于龈上或近牙龈处。如果需要用排龈线，一般推荐使用很细的（000号）的排龈线。为了减少修复体对牙周组织的影响，重要的一点是在开始治疗之前就要注重牙龈的健康。如果使用了无创预备技术，同时注意修复前牙龈处于良好的健康状况，那么控制以后的牙龈的出血通常都不成问题。

建议使用加成型硅橡胶印模材料或聚醚橡胶印模材料取模，不必使用个别托盘，质量好的成品托盘即可。必须将对颌牙弓印模同时送至技工室。建议使用硬蜡或硅橡胶颌间材料记录殆关系。如果降低了切牙牙尖高度，强烈建议使用半可调节殆架制作修复体，并用面弓转移殆关系。比色参见第2章。一般不需要制作临时修复体，除非在牙体预备时暴露了过多的牙本质。对于这种情况，应该制作临时修复体。

Other Clinical Procedures

Gingival retraction, using cords, is not usually necessary, as the margins are ideally placed supragingivally or juxtagingivally. If gingival retraction cord is necessary then a small-diameter (000) cord is recommended. To minimize the effect of the procedure on the periodontium it is important to optimize gingival health prior to commencing treatment. With atraumatic preparation techniques and good baseline gingival health, gingival control and haemorrhage are not usually problematic.

The use of an addition-cured polyvinyl siloxane or polyether impression material is recommended. The use of a special tray is rarely indicated, assuming good-quality stock trays are used. An impression of the opposing arch must be taken and sent to the laboratory. To register the occlusion it is suggested that a hard wax or a silicone interocclusal material is used. A face-bow transfer is required if the restorations are to be produced on a semi-adjustable

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这时，最好在牙体预备之前就用藻酸盐印模材料取印模，然后用它制作临时贴面，再用点状酸蚀法粘结于牙面上。如果没有牙体预备前的印模，则可以用蜡在预备的牙上恢复其正常外形，再取藻酸盐印模。还有一种方法是先对牙面进行点状酸蚀，再用复合树脂材料直接修复。

articulator, which is strongly recommended if the incisal tips have been reduced. Shade-taking has already been covered in Chapter 2. Provisional restorations are not usually required, unless large amounts of dentine have been exposed during tooth preparation. Should this be the case, provisional restorations may be indicated. This being the case it is preferable to take an alginate impression before tooth preparation, which can then be used to produce provisional veneers. These can then be spot-etched and bonded into place. If a preoperative impression is not available, the prepared teeth can be built up to normal contour with carding wax and an alginate impression taken. Alternatively the teeth can be spot-etched and a resin composite material placed directly.

粘结步骤

瓷贴面的粘结对技术要求非常高。为了减小操作失误的可能性，建议如下：

- 不要在模型上试戴瓷贴面，因为石膏会污染贴面的粘结面，降低粘结强度。
- 孤立牙上粘结贴面时要使用橡皮障。使用特殊的橡皮障夹子以获得一个良好的路径直达龈缘。

Luting Procedures

The luting of porcelain laminate veneers is very technique sensitive. To reduce the potential for error, the following is recommended:

- Do not try the porcelain laminate veneers on the model, as this will contaminate the fitting surface with die stone and reduce subsequent bond strength.
- Isolate tooth or teeth to receive the veneers with rubber dam. Special clamps are available that give good

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access to the gingival margins.

- 用无油抛光膏清洁牙面，使牙面可以保持湿润状态以便试戴。
- 确保贴面的粘结面呈毛玻璃状，然后涂布双硅烷偶联剂，干燥。
- 试戴时将水滴到贴面粘结面。切勿将干燥的贴面放在口内试戴，这可能会造成比色困难。一些生产商提供了水溶性试戴膏，在某些预备的牙体和贴面之间存在色差时特别有用。有资料显示，使用比色试戴膏或水可使修复体的最终颜色达到最佳效果。
- 按要求一个一个地调整贴面的组织面和邻接区。避免暴力就位，以免造成修复体的碎裂。
- 用乙醇去除试戴膏，如果粘结面被污染了，可用37%的正磷酸重新酸蚀，有资料显示使用氢氟酸再酸蚀也可以达到同样的效果。
- 再涂一遍双硅烷偶联剂。
- 酸蚀牙面涂布牙本质粘结剂。

- Clean the tooth or teeth with oil-free slurry of pumice. The tooth can be left moist for try-in.
- Verify frosted appearance of restoration fitting surface and apply silane-coupling agent and allow to dry.
- Try in the restorations with a drop of water applied to the fitting surface. Do not try in the restorations dry as this will make shade assessment difficult. Some manufacturers supply water-soluble try-in pastes, which are particularly useful if some shade discrepancy exists between the preparation and the veneer. It has been shown that using a shaded try-in paste or water gives the best appreciation of the final shade of the restoration.
- Adjust fitting surfaces and proximal contacts of veneers one by one as required. Avoid excessive insertion forces, as this will fracture the restoration.
- Remove try-in paste with ethyl alcohol and if the fitting surface is contaminated re-etch with 37% orthophosphoric acid, which has been shown to be as effective as re-etching with hydrofluoric acid.
- Reapply silane-coupling agent.
- Etch tooth and apply dentine-bonding agent.

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- 在牙体和贴面上分别添加一些非填充树脂。
- 将充填树脂粘结剂涂到贴面上，轻轻将贴面向龈方就位，轻轻振动着将贴面旋转就位于预备牙的唇面。
- 切端处用光固化 5 s。
- 用新毛刷去除多余的树脂，不要用棉球，棉球会将复合树脂粘结剂从边缘的界面带出来。
- 用牙线沿邻面边缘处去除多余的粘结剂。
- 根据生产厂家的说明书进行充分固化。通常需要每个面都进行 1 min 的透牙固化。

- Apply unfilled resin to restoration and tooth.
- Apply filled resin lute to the restoration and gently seat the veneer towards the gingival margin, rotating the veneer toward the labial surface of the preparation with a slight vibrating motion.
- Spot-cure the incisal edge for five seconds.
- Remove excess resin with a fresh brush, not cotton wool, as this drags the resin composite lute out of the marginal interface.
- Floss can be used to remove excess along the proximal margins.
- Cure fully, according to the manufacturer's directions for use. Usually each surface requires one minute of trans-tooth curing.

精修步骤

- 贴面粘固就位时，应尽量少调磨。
- 最好在下次就诊时（至少 24 h 以后）做最后的精修，那时树脂粘结剂才会完全固化。这是因为硅烷的完全粘结需要 24 h。
- 用细的（20 mm）水冷金刚砂钻做最后的精修。也可以使用带有特殊抛光尖的交互手柄（图 5-7）。

Finishing Procedures

- Should be minimal at the time of placement.
- Final finishing is best left until the next visit when the resin luting cement will be fully cured (at least 24 hours). This is because the silane bond requires 24 hours to mature fully.
- Use fine-grade (20mm) water-cooled diamond burs for fine finishing. A reciprocating handpiece with special finishing tips may be useful (Fig 5-7).

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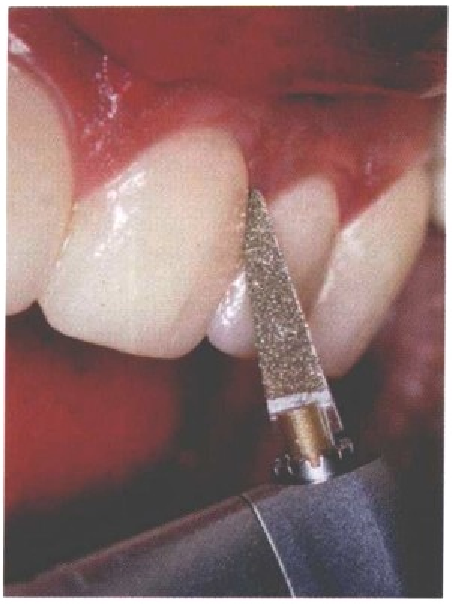


图5-7 正在使用Profin™ 尖和手机去除多余的粘结剂

Fig 5-7 Profin™ tip and handpiece being used to remove resin cement excess.

- 将抛光尖浸湿也很有效。
- 如果需要的话还可以用抛光条或抛光盘做进一步的修整。
- 用细的金刚砂（0.5～0.7 mm）抛光膏做最后修整。
- 牙线必须能通过邻接点，同时探针必须能够通过瓷－牙界面而不会卡住。
- 避免在修整过程中产热过高，因为高温会造成瓷裂并降低粘结效能，甚至损伤牙髓。因此一般都建议在修整过程中用冷水降温。

维护步骤

- 用水冷却的高速金刚砂钻重新修整，可去除边缘的色素沉着。
- 小的裂纹可磨除或直接用复合

- Impregnated polishing tips are also useful.
- Additional finishing may be accomplished with finishing strips and discs, if required.
- Fine diamond (0.5-0.7mm) polishing paste can be used for final finishing.
- Dental floss must pass interdentally and a probe must pass across the ceramic tooth interface without catching.
- Avoid overheating of the veneer during finishing, as excessive heat will fracture porcelain and degrade the bond or even injure the pulp. Water-cooling is therefore recommended.

Maintenance Procedures

- Staining at margins can be removed by refinishing with high-speed water-cooled diamonds.
- Small fractures can be ground out or

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树脂修复（详见第 7 章）。

- 明显的大裂纹则需要更换贴面，但是在更换之前要搞清楚出现折裂的原因。

- 如果有轻度的慢性牙龈炎，最好通过重新修整边缘，去除颈1/3处过大的凸度来治疗。如果这些方法无效，就需要更换贴面。

repaired directly with resin composite (see Chapter 7).

- Significant fracture will require replacement of a veneer, but diagnose the reason for fracture before replacing the veneer.
- Persistent gingival inflammation, if mild, is best treated by refinishing of the margins and removal of excess bulk in the cervical third. If this fails, replacement of the veneer will be necessary.

拓展阅读

Further Reading

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第 6 章 技工室技术

Technical and Laboratory Considerations

目　的

许多决定美学成败的关键因素依赖于临床和技工室的密切合作。出现问题往往是由于两者缺乏沟通造成的。本章的目的是仔细论证美容牙科学中的这一重要部分。

Aim

Many of the factors that determine aesthetic success are dependent on close collaboration between the clinician and laboratory. Problems, as and when they occur, are generally a result of a breakdown in communication. The aim of this chapter is to examine in detail this important area of aesthetic dentistry.

要　点

通过阅读本章，临床医师要熟悉一些影响美学效果的技工工艺，这将有助于提高读者制作出理想修复体的临床修复能力。

Outcome

On reading this section practitioners will become familiar with the ways in which good aesthetic results are dependent on certain technical factors and vice versa. This understanding will improve the reader's ability to achieve optimal results.

引　言

对患者和医师来说修复体的最佳美学效果与多种因素有关。除了适当的牙体预备和高质量的印模之外，还包括临床和技工室的衔接，特别是颜色的传递和材料的选择。如今，有许多

Introduction

Optimising aesthetic outcomes for patients and operators depends on a variety of interrelated factors. These include the clinical–laboratory interface–in particular, colour communication and material

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陶瓷材料供临床医师选择，这会引起认识上的混乱。选择合适的材料必须小心地考虑该材料的美学效果以及物理特性，并权衡利弊以减少风险（比如需去除的牙体组织量）。同样还要和患者讨论费用和使用寿命方面的问题。

selection, underpinned by appropriate tooth preparation and good-quality impressions. There is a range of ceramic materials available to practitioners today and this has led to considerable confusion. Choosing the right material needs careful consideration of the benefits of the material in terms of the potential aesthetic outcome and its physical properties balanced against the risks (for example, in terms of the amount of tooth tissue that requires removal). Equally, a discussion with the patient regarding cost and longevity is also required.

如果选择了合适的材料，那么就必须根据这一特定材料或系统的要求，进行适当的牙体预备。请注意，预备不足或预备过量都将影响修复体的最终美学效果，所以对于临床医师来说，很重要的一点就是要随机应变，因为不同的材料对牙体预备的要求略有不同。有研究表明临床医师往往以一种适合金嵌体或高嵌体等修复体的方式预备牙体，而不按照复合树脂或瓷修复的要求备牙，这显然是不合适的，因为金在较薄的地方表现出较好的强度，而复合树脂和瓷则不然，这就产生了一个问题，复合树脂因为太薄往往会在边缘发生折裂。

Having selected the material or materials that will be used, tooth reduction appropriate to the specific material or system must be carefully executed. Noting that both under- as well as over-preparation will affect the aesthetic outcome, it is important for practitioners to appreciate that different materials require subtly different tooth preparation. Research has shown that practitioners will frequently prepare a tooth in a way suitable for a gold inlay or onlay type restoration but request a resin composite or ceramic restoration to restore the unit. This is inappropriate, as gold is strong in thin section whereas resin composite and ceramic are not, and this poses a problem as resin composite will fracture off at the margins as a consequence of its relatively thin section.

完成了口内检查、修复体设计和

Once measured, considered and appro-

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适当的牙体预备之后，同样重要的是如何保持预备体的完整性以及维持预备牙与牙周组织的相互关系，因为这些都对修复体的长期临床效果产生十分重要的影响。但遗憾的是，很少有临床医师对临时修复体给予足够的重视，常常导致临时冠桥外形差、渗漏，增加了菌斑聚集的可能，长此以往，甚至会出现牙髓坏死。除此以外，临床医师在粘结最终修复体的时候，常常会发现牙龈已退缩，或牙龈出血以致影响有效的隔湿，使树脂粘结完全无法进行。

priate tooth preparation has been carried out, of equal importance is how the integrity of the preparation and, not least, its relationship to the periodontal tissues are preserved. These are crucial to the long-term clinical outcome. Unfortunately adequate consideration to the temporisation of cases is rarely given. This frequently results in poorly contoured, leaking provisional crowns and bridges that encourage plaque accumulation and loss of pulp vitality in the long term. In addition to these points, practitioners often come to cement the definitive crowns to find that there has been recession or there is gingival haemorrhage to the extent that effective isolation for resin bonding procedures is well nigh impossible.

全冠修复的技术要点

Technical Considerations for Full Coverage Restorations

金属烤瓷冠

金属烤瓷冠结合了两种不同的材料，即金属合金和瓷。这两种材料的物理性质和美学特性都有显著差异。金瓷修复体的成功完全有赖于下层的金属的强度以及外层覆盖瓷层的美学特性的结合。因此，金瓷结合界面特别重要。

Metal Ceramic Crowns

A metal ceramic crown unites two disparate materials, namely a metal alloy and porcelain. Both materials have markedly different physical and aesthetic properties. The success of this type of restoration relies on the strength of the underlying metal coupled with the aesthetic properties of the overlying porcelain. Of particular importance is the interface between the two materials.

技师需要用瓷遮盖内层的不反光

The technician needs to mask the under-

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的金属内核，这就会产生一个问题：如果内冠的塑型不成功，金属烤瓷冠就会看起来太暗，或者如果遮色层过厚，则会导致明度过高或过亮。为了确保全冠的美学效果达到最佳，临床医师需要进行足够的牙体预备，为遮盖内层金属底冠各种瓷提供足够的空间。牙体预备不足会导致冠的核瓷比例过高，由于瓷很亮，致使最终冠显得过亮或明度过高。合适的牙体预备，去除足够的牙体能给技师提供重塑美观牙冠的必要空间，这种牙冠是用色度相同但彩度不同的瓷粉堆塑而成的，颜色层次分明，同时保持牙体的唇面外形，最终产生一个自然逼真的修复体。预备体不足的部分，特别在颈1/3处，通常会因空间不够而导致技师不能有效地遮盖内层的金属核，在冠的颈部产生颈黑线（图6-1）。

lying non-reflective metal core with porcelain. This can be problematic. If this stage of the crown build-up process is not completed successfully, metal ceramic crowns can look very dark or, if over-opaqued, very high in value or "bright". To ensure that the aesthetics of the crown are optimal, the clinician needs to complete sufficient tooth reduction to create space for the different porcelains required to mask the underlying metal substructure. Insufficient space results in a crown with a relatively high proportion of core porcelain, which is bright, and so the crown appears to be too bright or too high a value. Appropriate preparation with sufficient tooth reduction provides the technician with the space necessary to build up an aesthetic crown of the same hue but with different chroma to provide depth to the colour of





图6-1 a. 金属烤瓷冠，颈1/3牙体预备不足；b. Procera™全冠修复后，并用复合树脂修复右上中切牙，注意牙龈反应良好

Fig 6-1 (a) Metal ceramic crown with insufficient depth of preparation in the cervical third. (b) After a Procera™ crown and resin composite addition to tooth 11. Note the excellent gingival response

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the crown, while still maintaining the labial contour of the tooth. The result is a natural-looking restoration. Under-preparation–in particular, in the cervical third–is a common occurance that results in a crown with a dark neck, given the lack of space for the technician to mask the underlying metal core effectively (Fig 6-1).

全瓷冠

使用全瓷冠，不需要遮盖内层的金属底冠，因为修复体不含金属。全瓷冠因其具有良好的美学效果，且能满足患者对生物相容性好的修复体的日益增加的需求，越来越受到欢迎（图6-2）。但是，全瓷冠的局限之处在于，这种修复体的强度取决于核或使用的内冠。大多数内冠或核明度较高，因此看起来相对较亮。全瓷冠比金属烤瓷冠要求牙体预备深度更大一些，因为临床医师必须为内层底冠和表层的瓷提供空间。除此以外，还有树脂或牙本质粘结全冠以及长石瓷的瓷贴面等其他修复体，这些修复体的牙体预备的深度都在0.5～0.8 mm之间，因此，全瓷冠并不是一种微创技术，与烤瓷金属全冠相比，需要破坏牙体组织更多一些。由于不含遮色内冠，所以瓷全冠可能无法有效遮盖变色的牙体或金属桩核，这样，可能需要去除更多的牙体组织，以防止不希望的颜色透过修复体显现出来。一些牙体严重变色病例可能会透色，因而不适合用无底冠的

All-Ceramic Crowns

With all-ceramic crowns there is no need to mask an underlying metal coping, as the restoration is metal free. As a consequence, all-ceramic crowns are increasing in popularity, offering good aesthetics and meeting patients' increasing demands for more biocompatible restorations (Fig 6-2). However, all-ceramic crowns have a limitation in that the strength of these restorations is dependent on the strength of the core or coping used. Most copings or cores have a high value and are therefore comparatively bright. All-ceramic crowns require greater depth of preparation than metal ceramic crowns, as the practitioner must make room for the underlying coping and veneering porcelain. Exceptions to this are resin- or dentine bonded crowns and porcelain laminate veneers, which are made from feldspathic porcelain. Typically the depth of preparation is between 0.5–0.8mm for these restorations. As a consequence all-ceramic crowns cannot be described as

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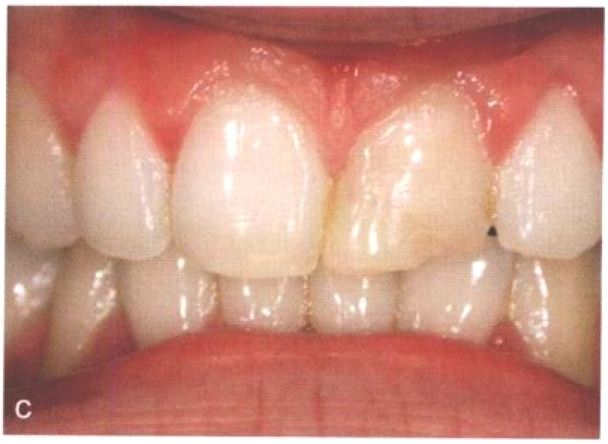


图 6-2 a. 用复合树脂修复的前牙；b. 为 Procera™ 全冠和贴面修复而做的牙体预备；c. 全冠和贴面最终修复后

Fig 6-2 (a) Anterior teeth with resin composite build-ups. (b) Patient with the teeth and veneer prepared for Procera™ crowns. (c) Patient with the final crown and veneer in place.

全瓷冠来修复。

minimal interventive techniques and in comparison with metal ceramic crowns are necessarily more destructive of tooth tissue. Systems that do not have opaque copings may not obscure the appearance of discoloured remaining tooth tissue or metal posts and cores. In these circumstances more tooth reduction may be needed to stop unwanted colours showing through the restoration. In certain cases the nature and depth of the discoloration may be such that an all-ceramic crown that does not have a coping is contraindicated.

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牙体预备

牙齿上有许多天然的解剖平面，它们在唇侧把牙齿分成颈部（龈部）、中部和切端三部分。在每一部分去除适量的牙釉质和牙本质，会给技师提供适当的空间来完成美观的全冠或贴面的制作。

这里介绍一个有用的小窍门。在进行全冠或贴面修复的牙体预备之前，用加成型聚乙烯硅氧烷材料取一个阴模。这个阴模还应该可以用于制作临时冠。当临床医师认为牙体预备已经完成后，用手术刀沿矢状面将阴模从中间剖开。将剖开的阴模放在备好的牙齿上，观察唇、腭侧壁的所有平面上去除的牙体组织量，在需要的地方适当调磨。对烤瓷金属全冠来说唇侧的最佳磨除量是1.2～1.5 mm，全瓷冠稍多一些（1.5 mm），瓷贴面0.5 mm。我们并不建议将制取硅橡胶阴模作为临床医师的常规手段。但它确实不失为一种定期检查校正临床医师牙体预备技术的有效手段。

如果将颊侧预备量不足的问题留

Tooth Preparation

Teeth have a number of naturally occurring anatomical planes. These can be divided on the labial surface into a cervical/gingival, mid-labial and incisal. Removing the optimum amount of enamel and dentine in each dimension will give the technician just the right amount of space to make an aesthetic crown or veneer.

A useful tip is to make a matrix prior to commencing the preparation for a crown or veneer using an addition-cured polyvinyl siloxane putty. This matrix can additionally be used to produce provisional restorations, should this be required. When the operator believes that the preparation has been finished, divide the matrix through its mid-line (sagitally) using a scalpel. Replace the matrix over the prepared tooth and observe the amount of tooth reduced in all the planes along the labial and palatal walls, adjusting the preparation where necessary. Optimal labial reduction is 1.2–1.5mm for metal ceramic crowns, slightly deeper (1.5mm) for an all-ceramic crown and 0.5mm for a porcelain laminate veneer. It is not suggested that practitioners should routinely use a silicone matrix. It is, however, a useful technique for periodically checking and calibrating an individual practitioner's preparation technique.

If under-preparation leaves the technician

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给技师，让他们制作一个具有天然外形的全冠或贴面，他就必须选择制作与邻牙颊面外形协调的冠或贴面，还是做一个颜色正确但外形凸起的修复体。这两种方法都无法得到令人满意的美学效果（图6-3）。全冠或贴面的颈1/3凸度过大容易导致菌斑堆积，产生龈缘炎，而这样就无法达到最佳美观效果，尤其是对笑线高的患者。另一个常常预备不足的部位是唇颊面的切1/2处。牙体预备不足可能使技师去除或增宽切缘以增加瓷量来遮盖内层的金属。不管哪种情况，虽然预备不足看起来似乎对牙体比较"友好"（磨牙较少），但事实上正好相反，因此必须在

with insufficient space on the buccal surface to produce a crown or veneer with a natural emergence profile, he or she must decide between achieving a matched buccal contour or overbuilding the crown or veneer buccally to produce the right colour. Either way the result will be an unsatisfactory aesthetic outcome (Fig 6-3). Overbulking the cervical third of crowns and laminate veneers can lead to plaque accumulation and problems with marginal inflammation, which may result in a less than optimal aesthetic outcome, in particular if the patient has a high smile line. Another area that is often under-prepared is the in-







图6-3 a. 过凸的前牙全冠，导致龈缘炎；b. 重新给患者进行牙体预备；c. 戴入诊断式临时冠。注意龈缘炎症有所缓解

Fig 6-3 (a) Overbulked anterior crowns with marginal gingivitis. (b) Patient with refined preparations. (c) Diagnostic temporaries in place. Note resolution of marginal inflammation.

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预备不足和预备过量之间把握平衡。

cisal half of the buccal or labial surface. Under-preparation may require the technician to move or widen the incisal edge to accommodate more porcelain, which would be needed to mask the underlying metal. In either situation, although under-preparation may seem more tooth friendly the converse can be true. In essence a balance must be struck between under- and overpreparation.

牙体预备的步骤

牙体预备的目的是为技师提供足够的空间，来制作结实耐用且美观的全冠或贴面。为了达到这一目的，临床医师需要在牙齿的唇侧、舌/腭侧、切端/殆面和邻面分别去除足够的牙体组织，为全冠制作提供足够的空间，预备体应近乎平行但不产生倒凹。有些医师喜欢分步进行牙体预备，如先磨殆面（切端），再磨邻面，最后才磨舌（腭）侧。

Stages of Tooth Preparation

The aim of tooth preparation is to provide sufficient space for the technician to make a crown or veneer which is both structurally durable and aesthetic. To achieve this effectively a practitioner must remove enough tooth tissue on the labial, palatal/lingual, incisal/occlusal and proximal surfaces to provide space for the crown without introducing undercuts, yet achieving a near-parallel preparation. Some clinicians prefer a staged process–for instance, occlusal/incisal reduction, then proximal reduction and then finally labial and palatal reduction, in that order.

建议临床医师参考以下步骤：

- 冠的设计——选择修复体的材料。选定了材料后，才能考虑各种材料需要磨除的牙体组织量。烤瓷金属全冠比树脂或牙本质粘结全冠在唇颊侧需要磨除更

It is suggested that practitioners proceed as follows:

- Design the crown–choose the material for the restoration. When choosing a material, it is helpful to consider the amount of preparation each type of material will require. A metal ceramic

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多的牙体组织。全瓷冠需要在唇侧和腭侧去除的牙体组织的量一样多，而且比树脂或牙本质粘结全冠或烤瓷金属全冠磨除的牙体组织更多。

crown needs more labial/facial reduction than a resin- or dentine-bonded crown. An all-ceramic crown needs an equal amount of tooth reduction on the labial and palatal surfaces and is less conservative of tooth tissue than either resin- or dentinebonded crowns or metal ceramic crowns.

- 在进行牙体预备之前，先比色并且记录下来。
- 对有临床症状的牙，进行牙髓活力测试，并用牙片检查根尖周状况。
- 适当的时候可以使用局部麻醉。
- 制取一个牙的术前阴模以备后面制作临时冠之用。再取一个阴模用来定期检查牙体预备的量。通常采用聚乙烯硅氧烷或是藻酸盐来取印模，待牙体预备完成后，将其放在牙的一侧用于复制树脂的临时冠。如果用藻酸盐取模，千万不要用次氯酸盐溶液浸泡或是用湿纱布包裹，因为过于潮湿，特别是次氯酸盐，会延迟临时冠和桥体材料固化。
- 另外一项临床技术就是使用模型蜡（图6-4），代替聚乙烯硅氧

- Assess and record the shade prior to tooth preparation.
- Test the vitality where indicated clinically and check the periapical status of the tooth radiographically.
- Local anaesthetic is given as appropriate.
- Obtain a preoperative matrix impression of the tooth or teeth which can be used to produce the provisional crown (s). Periodically take an additional one to check the amount of tooth reduction. Typically this is done with a polyvinyl siloxane or alginate impression, which is put to one side and used to make resin replica provisional crowns after preparation has been completed. It is recommended that if alginate is used it is not put in hypochlorite or wrapped in damp gauze, as excess moisture and, in particular, hypochlorite will retard the set of provisional crown and bridge materials.
- Another technique is to use modellers' wax (Fig 6-4) rather then polyvinyl

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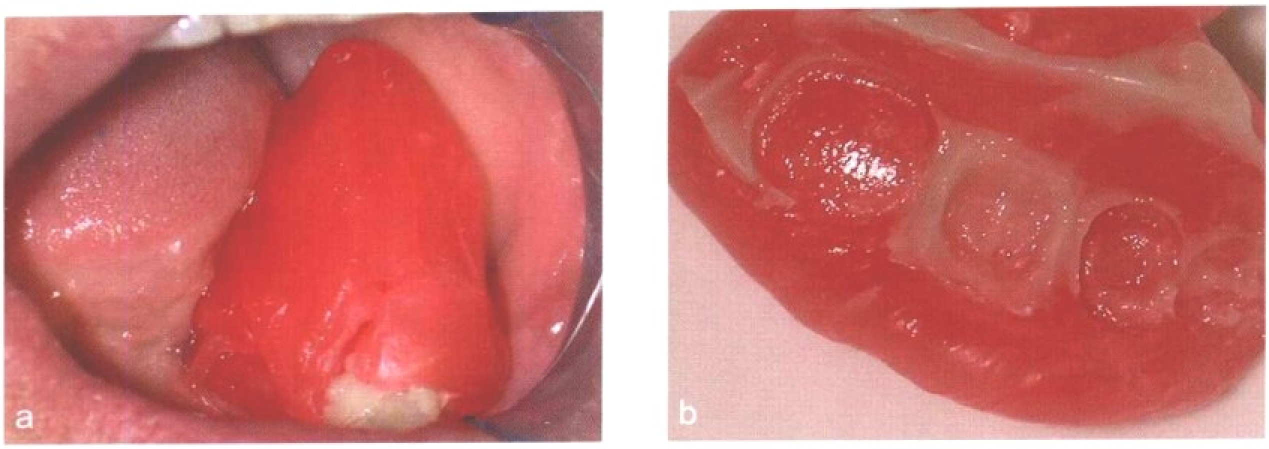


图 6-4　a. 模型蜡适用于制作单个牙的临时冠；b. 带临时冠的模型蜡

Fig 6-4　(a) Modellers' wax being adapted to a tooth to make a provisional crown. (b) Modellers' wax with provisional crown.

烷或藻酸盐。牙体预备之前，将软化的粉红色蜡围在牙上，待其冷却硬固。蜡要足量以保证有足够的强度。牙体预备之后，将用来制作临时冠桥的树脂填入蜡中。蜡的主要优点是可以修改取出的牙冠的外形。对于唇侧预备很少的牙体，可将蜡型的唇侧适当削薄以增加临时冠的厚度，使之更耐用。

siloxane or alginate. Softened pink wax is moulded around the tooth prior to tooth preparation and then allowed to cool and harden. Sufficient wax is needed to produce strength in bulk. The tooth is prepared and then a provisional crown and bridge resin is dispensed into the wax. The main advantage of the wax is that alterations to the shape of the crown can be readily achieved. For minimally prepared teeth some of the labial aspect of the wax can be removed labially to thicken the provisional crown, making them more durable.

- 在牙齿上磨出几个标记沟，以确定冠预备的最佳深度。

- Cut grooves into the tooth to achieve the optimum depth for the crown preparation.

- 不论哪种类型的全冠，其固位都取决于冠壁的长度和预备体的锥度。理想的锥度是15°～20°。

- Retention for crowns, irrespective of the type, is derived from the length of walls and angle of the preparation

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锥度过小，会增加产生倒凹的可能性，而锥度过大则会使冠的固位力下降。大部分固位力来自近远中面的预备。

taper. Ideally, the taper should be around 15-20 degrees; less than this increases the potential for developing undercuts and greater taper reduces the retention of the crown. Most of the retention is obtained from the mesial and distal reduction.

- 确保邻接点清晰。

- Ensure that the proximal contact points are cleared.

- 保持牙的天然解剖外形。

- Follow the natural contour of the tooth.

- 检查殆面预备情况，尤其是殆接触区，要确保留出足够的间隙。评估牙齿在不同方向上运动时牙体预备的厚度也同样重要。

- Check the occlusal reduction, in particular in relation to the occlusal contact area, ensuring that adequate space has been produced. It is also important to assess the depth of preparation in relation to excursive movements.

- 去除锐利的线角，磨光预备的牙体。这一步骤最好使用细砂水冷的抛光钻。一些临床医师发现使用龈缘修整器和釉质凿有助于抛光全冠预备体的边缘。这些器械可能有利于去除菲薄的无基釉碎片。

- Remove sharp-line angles and smooth the preparation. Typically this is done with fine-grade water-cooled finishing burs. Some clinicians find gingival margin trimmers and enamel chisels useful for refining the margins of crown preparations. Such instruments may be found to be especially useful for removing thin flashes of unsupported enamel.

- 必要时使用排龈线。建议将排龈线完全埋置于龈沟里，带着排龈线取模和制作临时冠。

- Place retraction cord if required. It is recommended that the cord is completely submerged in the crevice and left in situ for the impression and while provisional crowns are made.

- 制作临时冠，注意小心修整龈缘。避免龈缘粗糙很重要，确保

- Make the provisional crowns, taking care to trim the margins appropriately.

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临时冠龈缘的适合性，从而严密地封闭预备体的边缘。

It is important to avoid any roughness and to ensure that each provisional crown has close marginal adaptation and should therefore seal the preparation margins.

- 取模。
- 对于大多数单冠，可以不必记录颌位关系或使用面弓。
- 使用合适的临时粘结剂粘固不同的临时冠，一般最常使用的临时粘结剂是氧化锌丁香油粘结剂。这种粘结剂可以添加调节膏来改良。这在预备体固位力很大、去除临时冠困难时，通常是很有必要的。改良的临时粘结剂还可以用于最终修复体的临时粘固，有时修复体在永久粘固之前需要临时粘固，这种改良型粘结剂比较容易去除。

- Take the impression.
- For most single units an occlusal record or facebow is unnecessary.
- Fit the provisional crowns using appropriate temporary cement. Typically, provisional crowns are cemented with zinc oxide eugenol temporary cement, which can be modified by the addition of a modifier paste. This is usually necessary when the preparations are very retentive and problems may be anticipated when it comes to removing provisional crowns. Modified temporary cement can also be very useful for the provisional cementation of definitive restorations, which allows for ease of removal for modification if required prior to cementation using permanent cement.

牙体预备不要过于机械这一点很重要，因为过于机械就无法设计预备体的形状了。每颗牙都是不同的，因为牙齿都和对颌牙有关，牙齿的磨耗同样可以改变牙齿的外形。所以，临床医师应该注重的是全冠备牙原则，而不是对理想备牙外形的主观想像。

It is important not to adopt a mechanistic approach to the preparation of teeth and, as such, it is not possible to be prescriptive about the shape of preparations. Each tooth is different, as is its relationship with the opposing dentition. Equally tooth wear may have already reduced the dimensions of a tooth. Practitioners should therefore focus on the principles of preparing teeth for

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crowns rather than mental images of the appearance of idealized preparations.

冠修复成功的核心就是对固位原理的理解，换句话说，就是什么使得冠保持固位。一般说来，平行的就位道固位力最强。锥度约45°的类似金字塔的形状，如不使用粘结剂是没有固位力的。但对于锥度过大的预备体的认识还存在一个极大的误区，错误地认为粘结剂的可以弥补拙劣的技术缺陷。相反，预备体没有锥度会增加产生倒凹的可能性，特别是长预备体。除了金属烤瓷全冠外，所有其他类型的牙体预备的基本原则都是一样的，金属烤瓷冠需要唇面预备得多一些，以容纳金属和瓷层的双层厚度。

Central to the success of crowns is an understanding of the principles of retention –that is to say, what holds crowns in place. Generally speaking, a path of insertion that approaches the parallel is the most retentive. Shapes approaching pyramidal lines, with tapers around 45 degrees, are unretentive without using adhesive luting systems. It is inexcusable, however, to overtaper preparations in the mistaken belief that an adhesive luting system will compensate for poor technique. Conversely, lack of taper in a preparation increases the likelihood of introducing undercuts in the preparation. This is especially true of long preparations. The basic principles are the same for all types of preparation except for metal ceramics, where a deeper labial/facial reduction is needed to accommodate the combined thicknesses of metal and porcelain.

全瓷冠

人们对更美观的、不含金属的和具有生物相容性的修复体的需求日益增高。基于这一点，厂商们已经生产出了许多能够修复单颗牙的非金属美容修复材料系统。除了树脂或牙本质粘结冠以外，一般都是瓷系统。它们由长石质陶瓷构成。由于人们对目前使用的全瓷系统的特点存在一些混淆，因

All-Ceramic Crowns

Patients are demanding more aesthetic, metal-free, biocompatible restorations. In response to this, manufacturers have produced systems capable of producing single-unit aesthetic metal-free restorations. Typically these are ceramic systems, with the exception of resin- or dentine-bonded crowns, which are made from feldspathic

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此，我们将这些系统大致分成以下几类：

- 用普通的方式在CAD/CAM制作内冠上烤瓷的全瓷系统(Procera®)
- 无内冠的CAD/CAM全瓷系统(Cerec®)
- 铸压陶瓷系统（Empress Ⅰ®和Empress Ⅱ®)
- 用普通方式在氧化铝陶瓷内冠上筑瓷的全瓷系统(In-Ceram®和Techceram®)。

对这些全瓷系统有一个大致了解是十分必要的。全瓷系统需要用特殊的钻进行牙体预备（图6-5)。

用普通的方式在CAD/CAM制作内冠上烤瓷的全瓷系统

Procera®(Nobel Biocare, Gothenborg，瑞典）是一个相当新的瓷

porcelains. There tends to be some confusion over the nature of current all-ceramic systems. These systems are broadly classified as follows:

- Computer-aided design/computer-aided manufacture (CAD/CAM) produced copings with veneer of conventional porcelain (Procera®).
- CAD/CAM without coping (Cerec®).
- Pressed ceramic (Empress I® and II®).
- Conventional build-up with alumina coping (In-Ceram® and Techceram®).

It is important to have an understanding of these ceramic systems. Special burs are available for tooth preparation for all-ceramic systems (Fig 6-5).

CAD/CAM-Produced Coping with Conventional Build-up

Procera® (Nobel Biocare, Gothenborg, Sweden) is a relatively new system that also



图 6-5　瓷全冠牙体预备套装

Fig 6-5　All-ceramic preparation kit.

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体系，采用氧化铝内冠。代型用蓝宝石红宝石激光探头扫描之后形成预备体的数字化图像，并通过电子邮件的形式传送到技工室的网络交换中心。一台由计算机控制的研磨机，根据这些数字图像制作一个致密的氧化铝核，并把它送回原来的技工室。然后再在核上用普通方式烤瓷完成整个修复体的制作。内冠可以做成0.4 mm和0.6 mm两种厚度，这取决于牙本质磨除的量，为冠修复提供的空间有多少。较薄的内冠可以用在空间有限而又不可能进一步预备牙体的时候。比如可以用在短牙冠的殆接触区。可以用Panavia®或玻璃离子粘固剂之类的更传统的粘结剂粘结在牙齿上。

has an alumina coping. The die is scanned by a sapphire ruby laser to produce a digital image of the preparation and the image is sent by email to the “hub’ laboratory. A computer-controlled milling machine uses the digital image to produce a core of densely sintered alumina which is then sent back to the originating laboratory. The core is then layered with conventional porcelains to produce the completed restoration. The coping can be produced in two levels of thickness (0.4 or 0.6mm), which will have an effect on the amount of dentine removed to provide space for the crown. The thinner coping allows the technique to be used in areas where space is limited and further tooth reduction is not possible. This might be, for example, in occlusal contact areas on teeth with short clinical crowns. The material can be adhesively bonded to teeth with Panavia® or cemented with more traditional cements such as glass-ionomer cements.

无内冠的CAD/CAM全瓷系统

CAD/CAM系统既要在瓷块(Mikorna，瑞士)内复制一个近似冠，又要使用一个预备体的数码印模(Cerec®)。用瓷块研磨生产嵌体或冠，这两种方式都需要用到普通的烤瓷材料。这种全瓷系统的缺点在于需要价格昂贵的技工室设备，并且制作出的修复体颜色也相当单一，影响了修复

CAD/CAM without Coping

CAD/CAM systems use either an analogue crown to duplicate one in ceramic (Mikrona, Switzerland) or a digital impression of the preparation (Cerec®). Blocks of porcelain are milled to produce inlays or crowns, and both of these methods use conventional porcelains. Disadvantages of these systems include the relatively high

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体的美观效果。电脑里储存的信息将这种方式制作的修复体组织面，以及通过数码印模制作的修复体的𬌗面特征都表现出来。新一代的CAD/CAM系统已经在很大程度上克服了以上缺点，进一步研发有望取得更大突破，特别在光学印模的使用上。

cost of the laboratory equipment and that the restoration is largely limited to one shade only. This can restrict the quality of the aesthetic outcome achieved. Reservations have also been expressed about the fit of restorations produced in this way and also regarding the occlusal features of restorations made from a digital impression. Newer generations of these systems have largely overcome these limitations and further developments are to be expected–in particular, an increase in systems using optical impressions.

铸压陶瓷系统

铸压玻璃陶瓷的代表是Empress Ⅰ®或Ⅱ®(Ivoclar Vivadent，Schaan，列支敦士登)。Empress Ⅰ®是一种全瓷铸压系统，其缺点在于修复体只有一种颜色。与Inceram®相似，Empress Ⅱ®的冠桥修复体由两层材料构成：内层是由二矽酸锂制成的金属支架，外层由氟磷灰石陶瓷制作。支架或核是用失蜡法制成的。用磷酸盐包埋材料包埋蜡型，蜡型汽化后，用白榴石增强型玻璃陶瓷在压力作用下压入蜡型留下的空腔。和Inceram®不同的是，Empress Ⅱ®的外部瓷层较薄。这就需要提高修复体表面光洁度和特征，而不是仅仅形成一个大致可接受的牙冠外形。Empress Ⅰ® /Ⅱ®的组织面可以被氢氟酸酸蚀，以便粘结。

Pressed Ceramics

Examples of pressed glass ceramics are Empress I® or II® (Ivoclar Vivadent, Schaan, Liechtenstein). Empress I® is an all-ceramic pressed system and has the disadvantage that the restoration is made from one shade. In a similar way to Inceram®, Empress II® crowns and bridges comprise of two layers: an inner framework material made from lithium disilicate, coupled with an outer layer made from fluorapatite ceramic. The framework or core is made using the lost-wax technique. Wax is invested in a phosphate-bonded investment material and, after burn-out, the leucite-reinforced glass ceramic is pressed under pressure into the space left by the wax. Unlike Inceram®, the outer layer of Empress II® is thin. It is needed to improve the sur-

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face finish and characteristics rather than to make the crown's appearance acceptable. The fit surface of Empress I® and II® can be acid-etched with hydrofluoric acid allowing for adhesive bonding.

用普通方式在氧化铝陶瓷内冠上筑瓷的全瓷系统

Inceram®(Vita Zahnfabrik, Bad Säckingen，德国)冠包含两层结构。冠的强度来自氧化锆和氧化铝制成的内层核，将普通瓷粉烧结在核上，形成最终的修复体。制作Inceram®修复体时，需要将细氧化铝粉末附在有吸附性的耐火代型上，用这个代型烧结形成致密的晶核。这种核具有很高的强度和弹性模量，但这种高强度是以牺牲外形为代价的，因为核材料非常不透光。所以需要在核上烧结一层普通低熔瓷，以得到一个高强度的、美观的牙冠。此外，铝含量高使其对大多数酸具有耐酸性，所以应选择无黏性的粘结材料粘固Inceram®冠。

Conventional Build-up with Alumina Coping

Inceram® (Vita Zahnfabrik, Bad Säckingen, Germany) crowns consist of two distinct layers. The strength of the crown is derived from the inner core, which is made from zirconium and aluminium oxide; conventional porcelains are fired onto the core to produce the definitive restoration. To make an Inceram® restoration, fine alumina powder is applied to an absorbent refractory die, which is fired to produce a dense crystalline core structure. The core has a high strength and elastic modulus, but the improved strength is sacrificed at the expense of appearance, as the core material is very opaque. Conventional low-fusing porcelains are therefore applied over the core to create an aesthetically pleasing crown with high strength. Additionally, the high content of alumina makes it resistant to most acids and so a non-adhesive cement is used to cement the Inceram® crown.

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金属烤瓷冠

金属烤瓷冠由一个粘结合金的复合物构成，即在合金制成的金属支架上烧结上一层低熔陶瓷。现在有多种合金配合许多不同的瓷系统供使用。其中Captek®系统（Schottlander and Davis，Letchworth，英国）在技术上有所不同。其独特之处在于不需要通过铸造形成金属底冠，对于技师和临床医师来说，成本低，操作方便。除核是用贵金属材料制成之外，冠的基本结构与普通的金属烤瓷冠一样。在耐火代型上铺一层蜡片，焙烧形成一个疏松多孔的表面，然后浸入富含金的蜡片，将这个复合体再次焙烧，最后将普通烤瓷烧结在上述底冠上。有报道称，这种冠具有良好的边缘适合性和生物相容性，而且它与传统的金属烤瓷冠相比有一个"更温暖"的外观，因为金核的金黄色弥漫了整个牙冠。贵金属与牙齿的粘结剂一直都不可靠的，直到最近，可粘结黄金的Panavia®树脂粘固剂的应用才解决了这一问题。

Metal Ceramic Crowns

Metal ceramic crowns are made from a combination of a bonding alloy, which forms the metal framework onto which low-fusing porcelains are fired. A variety of alloys are available, together with many different porcelain systems. A variation in technique is Captek® (Schottlander and Davis, Letchworth, UK). Uniquely, this technique does not require a casting process to form the metal substructure, which can be an advantage for some laboratories and practitioners in terms of reduced costs and convenience. The basic structure of the crown is similar to conventional metal ceramic crowns, except that the core is made from a precious metal. A wax strip is applied to a refractory die and fired to produce a relatively porous surface, which is subsequently impregnated with a goldrich wax strip. The combination is fired again and conventional porcelain finally applied to the resulting substructure. The crown is reported to have good marginal fit and biocompatibility. The crowns are considered to have a "warmer" appearance than conventional metal ceramic crowns because the yellow colour of the gold core pervades the crown. Until recently adhesive bonding of precious alloys to teeth was unreliable. The use of Panavia® resin luting cement, which bonds to yellow gold,

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has overcome this problem.

临时冠

临床医师可以用临时冠来评估所设计的修复体的形状和外观，另外，患者有机会在技工室制作修复体之前，评判最终修复体的外观、形状以及适合性。这对那些前牙要做很大改变的病例非常有用，比如增加所有牙齿的长度、关闭中线间隙或多个牙间隙等。制作临时冠主要有两种方法：使用树脂复制技术以及使用成品冠。笔者比较喜欢前一种方法，原因如下：

- 由于临时冠与进行牙体预备之前牙齿的大小一致，故可维持原有的殆关系，保持其稳定，增加患者的舒适感。
- 在技工室最终完成修复体之前，任何殆关系都可以根据需要进行检验和调整。
- 可以防止对颌牙过度伸长，还可防止邻牙移位。
- 可根据需要检验和调改龈缘外

Provisional Crowns

Provisional crowns allow the practitioner to assess the shape and contour of the planned restorations. In addition the patient also has a chance to critique the shape, contour and fit of the final restoration before it is produced by the laboratory. This is very useful when major changes are planned to the anterior teeth–for example, an increase in overall tooth length or the closure of a midline or multiple diastema. There are essentially two ways of producing provisional crowns: the resin replica technique and the use of preformed crowns. The authors prefer the resin replica technique for the following reasons:

- Occlusal relationships are maintained and stabilised, as the provisional crown(s) have the same dimensions of the tooth prior to preparation, which can be more comfortable for the patient.
- Any reorganisation of the occlusion can be tested and adjustments made where needed before the definitive restorations are produced by the laboratory.
- Passive "over"-eruption of the opposing teeth, let alone movement of adjacent teeth, can be prevented.
- The gingival contour can be tested and

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形，产生一个最佳的牙面外形。

- 成本低廉。
- 诊断蜡型可以复制也可用于试戴，使患者和医师都能够检验最终修复体的外形、适合性及最终修复体的成功率。

成品临时冠可以达到与树脂复制临时冠同样的效果，但是我们还是需要您了解使用这种冠比较费时，此外，成品临时冠不能精确地保持殆关系和邻牙的位置关系。

软组织处理

印模的目的在于准确记录预备体的外形，特别是边缘形态，以保证技师能制作出合适的修复体。完成牙体预备后，接下来是制作临时冠，然后取模，但有些医师喜欢先取模。不管是哪种方法，取印模很重要的一步是软组织的处理。

理想的龈缘位置应该是位于龈沟内，这种情况是否需要采用牙龈退缩技术还有待商榷。如果牙龈不出血，印模材料通常可以清晰地记录边缘的状态。但如果出血就会有问题，有些临床医师可能会用到牙龈收缩剂退缩牙龈。

adjustment carried out if needed to give an optimal emergence profile.

- Lower costs.
- A diagnostic wax-up can be duplicated and matched, allowing both the patient and dentist to test the shape, fit and potential success of the definitive restorations.

Preformed provisional crowns can achieve the same results as replica crowns. It is suggested, however, that the use of such crowns can be more time-consuming. In addition, preformed provisional crowns are not as accurate in terms of maintaining occlusal and proximal relationships.

Soft-Tissue Management

The aim of an impression is to record accurately the preparation including the margins to enable the technician to produce a well-fitting restoration. Following preparation, the next stage is to make the provisional restoration and then take the impression, although some practitioners take the impression first. Whichever way round, an important part of impression-taking is management of the soft tissues.

The ideal position for the gingival margin is within the gingival crevice. The need to use gingival retraction techniques in such situations is questionable. In these circumstances the impression material should record the margin adequately, provided

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最新发明的一种材料名为 Expa-syl^{TM}（Kerr/Hawes UK，Peterborough，UK）。这种材料是一种含有氯化铝、微化瓷粉和水的糊剂，其中氯化铝能够起到收缩剂的作用控制出血，微化瓷粉和水起屏障保护作用。取模之前将其放在龈沟内 1～2 min，然后用水冲掉即可。Expa-syl^{TM} 可用于预备体的龈缘位置在龈沟内或稍下方时，其他情况下，则使用排龈线更为恰当（图 6-6）。

there is no bleeding. If bleeding is a problem some practitioners may use astringents to reduce it. A recent innovation is a material called Expa-syl^{TM}(Kerr/Hawes UK, Peterborough, UK). This material uses a paste containing aluminium chloride, which acts as an astringent to control bleeding, and micronised kaolin and water, which act as a barrier. The material is left in the gingival sulcus for one to two minutes and then washed away before the impression is taken. Expasyl^{TM} is useful for preparations

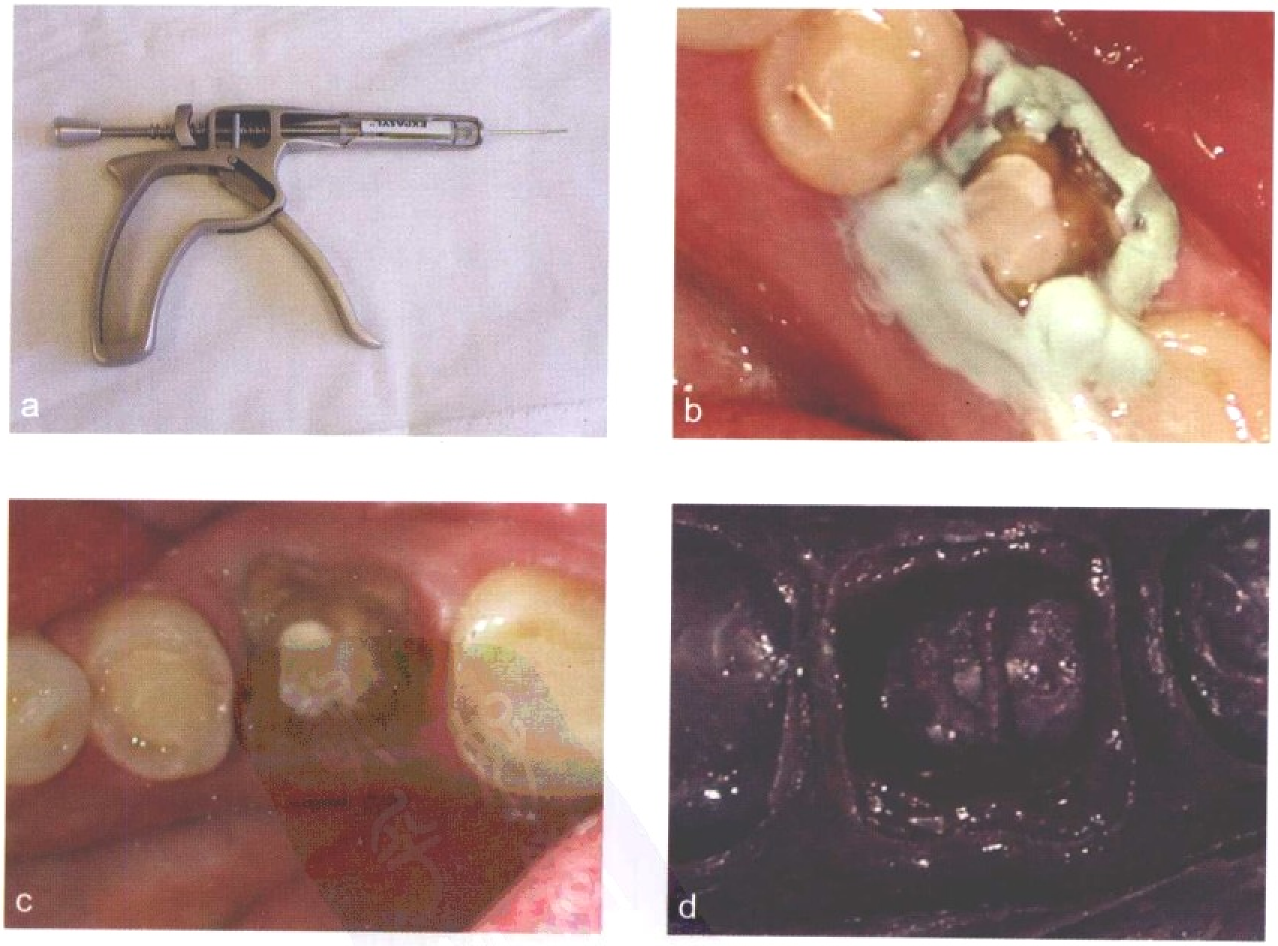


图 6-6 a. Expa-syl^{TM} 系统；b. 在预备体周围放置 Expa-syl^{TM} 材料；c. Expa-syl^{TM} 材料冲洗掉后，显现出预备体边缘；d. 预备体的印模

Fig 6-6 (a) Expa-Syl^{TM} system. (b) Expa-Syl^{TM} placed around a preparation. (c) Expa-Syl^{TM} washed away, showing preparation margins of tooth. (d) Impression of the preparation.

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finished within or just below the level of the gingival cervice, otherwise retraction cord is more appropriate (Fig 6-6).

有些临床医师会使用电刀对龈缘形态稍做调整。该技术的优势是能控制受损牙龈组织的出血。但使用时必须小心，因为使用不当可能造成软组织坏死。电刀修整术后可以立即取模，也可以过几天等伤口愈合后再取模。延迟取模效果更好，因为电刀修整术后牙龈退缩的现象相当普遍。电刀修整技术禁用于安装有心脏起搏器的患者，同时必须使用塑料器械以减少对临床医师产生电击的危险。

Some practitioners use electrosurgery for minor alterations to the gingival contours. An advantage of this technique is that it can control haemorrhage in traumatised gingival tissues. Care must be taken when using this equipment, as inappropriate use may cause tissue death. Following electrosurgery, the impression can be taken immediately or after a few days to allow the tissues to heal. A delay is advantageous, as recession is relatively common following-electrosurgery. Electrosurgery is contraindicated in patients with pacemakers, and plastic instruments must be used to reduce the risk of electric shock to the operator.

最常用的软组织处理方法是使用排龈线，可以配合收缩剂使用也可单用。该技术可分为单线法和双线法，单线法是向预备体周围注射印模材料时要将其取出，双线法是只取出其中一根，另一根留在龈沟内。笔者喜欢将排龈线留在龈沟里取模。如果龈缘位置很深，就会出现许多问题。首先，这样的牙应该做全冠吗？应该在全冠修复体下方留下一些直接修复材料吗？或者应该用冠延长术暴露边缘吗？每种临床情况都是不同的，这些左右为难的临床问题，没有简单的答案。

The most commonly used method of soft-tissue management is retraction cord used with or without an astringent. Techniques vary from a single cord, which is removed as the impression material is syringed around the preparation, to a dual cord approach with one left in and one removed. The authors' preference is to leave the cord in while taking the impression.With very deep margins a number of questions are raised. First, should the tooth be crowned? Should a direct restorative material be left beneath the crown? Or should crown-lengthening be used to expose the margin? Each clinical situation is different and for

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this difficult clinical dilemma there is no easy answer.

印模材料

可供选用的印模材料主要有四种：

- 聚硫型
- 聚醚型
- 缩聚型聚乙烯硅橡胶
- 加成型聚乙烯硅橡胶

聚硫型印模材料并不作常规使用，因为其固化时间长，精确性差。相反，缩聚型聚乙烯硅橡胶印模材料使用比较普遍，尽管也存在收缩引起尺寸精度差的问题。有证据表明，临床医师应该使用加成型聚乙烯硅橡胶或聚醚型印模材料，最好配套使用自动搅拌机调拌材料。聚醚型印模材料最常用于种植病例，因为它的硬度高，但存在明显倒凹时，则不宜选用此种材料。如果使用聚醚型材料，在消毒印模时要尤其小心。因为印模会吸水而引起形变。所以，印模传送时一定要保持干燥。

Impression Materials

Essentially there are four types of impression materials available to practitioners. These are:

- polysulfide
- polyether
- condensation-cured polyvinyl siloxane
- addition-cured polyvinyl siloxane.

Polysulfide-based impression materials are not used routinely because of the long setting time and poor accuracy. In contrast, condensation-cured polyvinyl siloxane impression materials are used more widely, despite their poor dimensional accuracy related to shrinkage. There is clear evidence, however, that practitioners should use either an addition-cured polyvinyl siloxane or a polyether impression material, preferably dispensed by an automixing machine. Polyether impression materials are used mostly for implant cases because of their rigidity, which precludes their use when significant undercuts are present. If polyether materials are used, care must be taken when the impression is disinfected. The impression can absorb water, and this will cause distortion. Consequently the impression must be transported dry.

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树脂复制技术的临床步骤

成形法

如果不想改变患者的殆关系，就需要用树脂复制技术按以下步骤制作临时冠。

- 制取单颌的藻酸盐印模，包括将要预备的牙齿。如果牙冠准备做树脂冠或牙本质粘结冠，有一个有用的小窍门，就是在将要预备牙的唇侧加一层材料以增大牙冠的体积。之所以这样做是因为用0.5 mm的厚度制作的树脂临时冠太薄，不足以抵抗殆力，而且还会透出临时粘结剂的颜色，使临时冠显得很白。这种方法在制作临时贴面时也非常有用。
- 把藻酸盐印模放在一旁。注意不要将印模放在次氯酸消毒液中，否则会妨碍临时冠、桥材料的固化。保持印模的湿润也同样重要，但太过潮湿也会有碍固化。
- 在这一阶段比色。
- 进行牙体预备。
- 必要时可使用排龈线，将其完全放进龈沟内。

Clinical Stages for the Resin Replica Technique

Conformative Approach

When no changes are planned to the patient's occlusal scheme, the stages needed to produce a provisional crown using the resin replica technique are:

- Take an alginate impression of the arch, including the teeth to be prepared. A helpful tip if resin- or dentine-bonded crowns are planned is to add material to the teeth to be prepared on the labial surface to increase the bulk of the crown(s). This is because a preparation depth of 0.5mm results in a resin replica crown which is too thin to withstand occlusal loading and the temporary cement will be seen through the crown, which appears very"white". This technique is also very useful when provisional veneers are necessary.
- Put the alginate impression to one side. Do not place it in a disinfection solution of hypochlorite, as this will retard the set of provisional crown and bridge materials. Equally, it is important to keep the impression damp,, but excessive moisture will retard the set.
- Take the shade at this stage.
- Carry out tooth preparation.
- Place retraction cord if needed, totally submerging the cord in the crevice.

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- 排龈线留在龈沟内取模。
- 检查牙体预备前取的藻酸盐阴模是否能重新就位。
- 调拌临时冠桥的材料，倒入藻酸盐阴模中，小心不要产生气泡。材料不要充填过量，因为这样做成的冠或桥会额外增加打磨的负担。
- 重新将阴模就位，直到临时冠桥的材料固化至胶状。
- 取下藻酸盐印模。临时冠桥可能会和阴模一起取出，也可能仍在口内。如果临时冠留在藻酸盐阴模里，通常可以方便地用剪刀修整龈缘。如果临时冠还留在预备牙上，就应该在材料完全固化之前取下，以免锁在预备体和邻牙倒凹中。
- 用高速水冷细砂钻以及抛光盘磨去多余的材料。
- 如果制作出的临时冠有气泡，只要气泡不在冠的龈缘，都可以用颜色合适的光固化复合树脂修

- Take the impression, leaving the retraction cord in place.
- Check that the preoperative alginate matrix can be reseated.
- Mix the provisional crown and bridge material and place it in the matrix impression, taking care not to introduce air blows. Try not to place excessive amounts of material, as the crown(s) or bridgework will require excessive finishing.
- Reseat the matrix and allow the provisional crown and bridge material to set to a gel stage.
- Remove the alginate impression. The provisional crown(s) or bridgework will either come out with the matrix or stay in situ. If the temporaries are still in the alginate, it is possible and often easier to trim the margins with a scalpel. If the temporaries are retained on the teeth, it is necessary to remove them from the preparations before full set of the material locks them on to the prepared teeth by engaging proximal undercuts.
- Excess material should be removed with high-speed water-cooled finegrade finishing burs and finishing discs.
- If there are air blows in the provisional crowns these can be rectified by applying light-cured resin composite of

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整。但如果气泡过多、过大或是在龈缘上出现气泡，那么应谨慎返工。

- 重新试戴临时冠。检查殆关系和边缘适合性。
- 然后用合适的临时粘结剂粘固临时冠或桥。传统观念认为，如果打算用树脂粘结修复体，就不宜使用含有丁香酚的临时粘固剂，这是因为丁香油酚会残留在牙本质小管里，致使单体凝固，最终使复合树脂粘结剂软化变色。但近年来研究表明，常规进行的牙本质酸蚀处理可去除牙本质小管里残留的丁香油酚。所以现在也可以使用含有丁香油酚的临时粘固剂，来粘固为树脂粘结修复体预备的牙体上做的临时冠。
- 用咬合纸检查殆关系。最常用的咬合纸为 40～50 μm 厚（Bausch Articulating Papers Inc.，One Chestnut Street，Nashua，NH

a suitable shade, provided the air blows are not at the margins of the crown. If there are significant numbers of air blows, the air blow is large or located at the restoration margin, then it is prudent to start again.

- Retry the crowns and check the occlusion and marginal adaptation.
- The crown(s) or bridgework is then cemented with an appropriate temporary cement. Traditionally, it has always been considered that eugenol-containing temporary cements are contraindicated if resin-bonded restorations are planned. This is because eugenol is retained in the dentinal tubules, resulting in plastinisation of the monomer and subsequent softening and discoloration of the resin composite luting cement. However, recent investigations have shown that the routine use of an etchant on dentine will remove residual eugenol from the dentinal tubules. So it is now possible to use eugenol-containing temporary cements for the cementation of provisional restorations of preparations destined to be restored with a resinbonded restorations.
- Check the occlusion with articulating paper. The most commonly used articulating paper is around 40-50 μm thick (Bausch Articulating Papers Inc.,

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03060，美国）。如果小心使用，仔细听牙齿接触音，这种咬合纸就有非常好的效果。还有一些咬合纸薄得多——GHM咬合纸，厚10～15 μm——最精确的是Shimstock咬合纸（Hanel Medizinal，Nurtingen，Germany），只有10 μm厚甚至更薄。不论使用哪种咬合纸，患者的看法以及他们触觉都是最重要的。这里推荐使用Miller镊子来夹持咬合纸。这种镊子还有助于医师用一种颜色的咬合纸检查正中关系，用另一种颜色的咬合纸来检查非正中关系。这种成型法一般只需要少量调𬌗。

One Chestnut Street, Nashua, NH 03060, USA). Provided it is used carefully, listening to the teeth contacting, it is perfectly acceptable. Other papers can be much thinner– GHM paper at 10-15 μm thick–with the most accurate being Shimstock (Hanel Medizinal, Nurtingen, Germany), which is 10 μm thick or less. Whichever technique is used, the view of the patient and their perception of contacts is most important. It is recommended that Miller forceps are used to hold articulating paper. It also very helpful to check centric contacts with one colour of articulating paper and excursive contacts with another colour paper. With the conformative approach minimal occlusal adjustment is typically required.

- 告之患者如有问题随时复诊，特别是临时冠脱落时。同时还要告戒患者不要吃颜色很深的食物。

- Instruct the patient to return if there any problems–particularly if the provisional crown(s) become uncemented. The patient should also be warned about eating high-colour-content food.

重筑法

此法只适用于计划改变𬌗关系的患者时，如升高患者的垂直距离。在这种情况下，制作树脂冠或桥的临床步骤如下：

Reorganised Approach

This is when changes are planned to a patient's occlusion–for example, an increase in the vertical dimension of the occlusion. The stages to producing resin replica crowns or bridgework in such cases are as follows:

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• 分别制取上下颌藻酸盐印模。

• 使用面弓记录上颌牙弓对关节的最终铰链轴的位置。

• 用合适材料记录正中关系位，或者后退接触位关系。笔者推荐使用硬蜡（Moyco Beauty Wax）或硬质硅橡胶颌位记录膏。

• 要求技工室把工作模型固定到半可调𬌗架上。

• 调整𬌗关系的垂直距离，并要求技工室按照设计的垂直关系和美学标准完成诊断蜡型（图6-7）。

• 要求技工室用牙色蜡制作诊断模型，并给患者看，征得其同意。这时确定修复体的颜色。

• 一旦患者认可了该设计方案，就要求技工室用真空搅拌的石膏

• Take upper and lower alginate impressions.

• Use a facebow to record the position of the upper arch in relation to the terminal hinge axis.

• Record centric relation or the retruded contact position with a suitable material. A hard wax (for example, Moyco Beauty Wax) or hard silicone bite-registration paste is recommended.

• Ask the laboratory to mount the casts on a semi-adjustable articulator.

• Adjust the vertical dimension of occlusion and ask the laboratory to diagnostically wax-up your planned occlusal and aesthetic scheme (Fig 6-7).

• Ask the laboratory to do this in tooth-coloured wax and show it to the patient to get their agreement to what is proposed. Take and agree the shade at this point.

• Ask the laboratory to duplicate the cast and diagnostic wax-up, once it has



图6-7 在半可调𬌗架上制作诊断蜡型

Fig 6-7 Diagnostic wax-up on a semiadjustable articulator.

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翻制工作模型和诊断蜡型，并要求他们提供空气吹压形成的模板。有些技工室会送来真空成型的牙托，这样做是不合适的，因为这种材料太厚，无法复制出细节。理想的材料厚度是1 mm。

been agreed, in vacuum-mixed stone and ask them to provide a blow-down template. Some laboratories will send a vacuum-formed soft splint. This is not suitable, as the material is too thick and fine detail will not be reproduced. A material with a thickness of 1mm is considered to be optimal.

- 另外，如果直接使用复合树脂修复体修复磨损的前牙，也可在椅旁直接用加成型硅橡胶印模材料，在翻制的模型上制作一个聚乙烯硅氧烷模板。

- Alternatively, if directly placed resin composite restorations are being used to restore worn anterior teeth, a polyvinyl siloxane template can be made on the duplicated cast at the chairside using an addition-cured polyvinyl siloxane impression putty.

- 进行牙体预备。如有多个牙齿需要预备，有时可以分步进行。

- Carry out tooth preparation. With multiple preparations this is sometimes done in stages.

- 这一阶段，可以直接取模。也可以先试戴临时冠桥，评价患者对𬌗以及美学效果的反应。当患者有多个牙齿需要预备，又要改变𬌗关系时，我们强烈推荐后一种方法。如果进入到了最终修复阶段，才发现患者不能接受这种𬌗关系的改变，或者不喜欢完成的冠桥外形，那医师将很难收场。

- At this stage it is possible to proceed directly to the impression stage. Alternatively, provisional crown(s) and or bridgework can be placed to assess the patient's response to the proposed occlusal and aesthetic scheme. This latter approach is strongly recommended if multiple teeth have been prepared and substantial occlusal changes are planned. It is disastrous to proceed to the definitive stage and then find that either the patient cannot tolerate the change or does not like the appearance of the completed crowns and bridges.

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如果直接进入印模阶段，则临床步骤如下：

- 需要时可放置排龈线，要将其完全置于龈沟内。
- 选用合适的印模材料取模。
- 调拌制作临时冠的材料，放进模板中，注意不要产生气泡。注意材料不宜充填过多，因为这样的冠桥就需要过多的打磨抛光。
- 将模板重新就位，让材料固化至胶状。
- 去除模板。临时冠桥可能会和模板一起取出，也可能留在已预备的牙齿上。如果临时修复体仍在模板中，那么轻轻弯曲模板则很容易取出。若临时修复体留在了牙上，材料会锁结到倒凹中，所以就要趁材料没有完全固化时就将其从预备体上取下。
- 用抛光钻或抛光盘去除多余材料。
- 选用合适的粘固剂粘固临时冠桥。
- 用咬合纸检查殆关系。理想的咬合纸厚为10～15 μm。用Miller镊夹住咬合纸，最好用一种颜色

If proceeding directly to the impression stage, the clinical stages are as follows:

- Place retraction cord if needed, totally submerging the cord in the crevice.
- Take the impression with an appropriate impression material.
- Mix the provisional crown and bridge material and place it in the template, taking care not to introduce air blows. Try not to place excessive amounts of material, as the crown(s) or bridgework will require excessive finishing.
- Reseat the template and allow the material to set to a gel stage.
- Remove the template. The provisional crown(s) or bridgework will either come out with the template or be retained on the prepared teeth. If the temporaries are still in the template it is very easy to remove them by gently flexing the template. If the temporaries remain on the teeth it is helpful to remove them from the preparations before they are fully set, as the material can lock into undercuts.
- Excess material can be removed with finishing burs or discs.
- The crown(s) or bridgework is then cemented with an appropriate temporary cement.
- Check the occlusion with articulating paper with ideally a thickness of 10–15 μm. Miller forceps can be used to

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的咬合纸检查正中𬌗，而用另一颜色的咬合纸检查非正中𬌗。

hold the paper. It is helpful to check centric contacts with one colour of articulating paper and excursive contacts with another colour paper.

• 告之患者不适随诊，特别是临时冠脱落时，更应及时复诊。同时还要告戒患者不要吃颜色很深的食物。

• Instruct the patient to return if there are any problems–particularly if the provisional crown(s) become uncemented. The patient should also be warned about eating high-colour-content food.

若用临时修复体来检查患者的耐受程度和接受程度，建议按照以下临床步骤进行：

If the provisional restorations are to be placed to test tolerance and patient acceptance it is suggested that the clinical stages are as follows:

• 现在已有各种Vita®色系的临时修复体材料供选择，这对于那些临时修复体需要使用一段时间的患者很有用。但必须和患者说明一点，不论是哪一种临时冠桥材料，都易被深色食物着色，如咖喱。特别那些临时冠需要使用一段时间的的患者。

• Provisional crown and bridge material in various Vita® shades are now available. This is helpful if the provisional restorations are to be in place for some time. Patients must be warned, however, that any provisional crown and bridge material will pick up staining from certain heavily coloured food stuffs–curries, for example. This is particularly relevant if the provisional crowns are to be in place for some time.

• 调拌制作临时冠的材料放入模板中，注意不要产生气泡。材料不宜充填过多，因为这样冠桥就需要过多的打磨抛光。

• Mix the provisional crown and bridge material and place it in the template, taking care not to introduce air blows. Try not to place excessive amounts of material, as the crown(s) or bridgework will require extra finishing.

• 将模板重新就位，让材料固化至

• Reseat the template and allow the ma-

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胶状。

terial to set to a gel stage.

- 去除模板。临时冠桥可能会和模板一起取出，也可能留在已预备的牙齿上。如果暂时修复体仍在模板中，那么轻轻弯曲模板则很容易取出。如果暂时修复体留在了牙上，材料会锁结到倒凹区，所以要趁材料没有完全固化时就将其从预备体上取下。
- Remove the template. The provisional crown(s) or bridgework will either come out with the template or be retained on the prepared teeth. If the temporaries are still in the template it is very easy to remove them by gently flexing the template. If the temporaries are still in situ it is helpful to remove them from the preparations before they are fully set, as the material can lock into undercuts.
- 用抛光车钻或抛光盘去除多余材料。
- Excess material can be removed with finishing burs or discs.
- 然后选用合适的粘固剂粘固临时冠桥。
- The crown(s) or bridgework are then cemented with an appropriate provisional cement.
- 检查𬌗关系。
- Check the occlusion.
- 患者复诊时，如需要，应调𬌗，修改临时冠的外观形态。
- Review the patient, adjusting the occlusion, contour and shape of the crowns if necessary.
- 询问患者是否乐意接受所做的修改。
- Check the patient is happy with the proposed changes.
- 取上、下牙弓藻酸盐印模。
- Take alginate impressions of both arches.
- 使用面弓记录，将上颌模型固定到半可调𬌗架上。
- Take a facebow record to allow the maxillary cast to be mounted in a semiadjustable articulator.
- 用硬蜡记录正中关系位或后退接触位关系，要求技工室用记录的𬌗关系固定下颌模型。
- Record centric relation or the retruded contact position using a hard wax and ask the laboratory to mount the lower cast using this record.
- 然后技工室才能在𬌗架上常规
- The laboratory can then produce a

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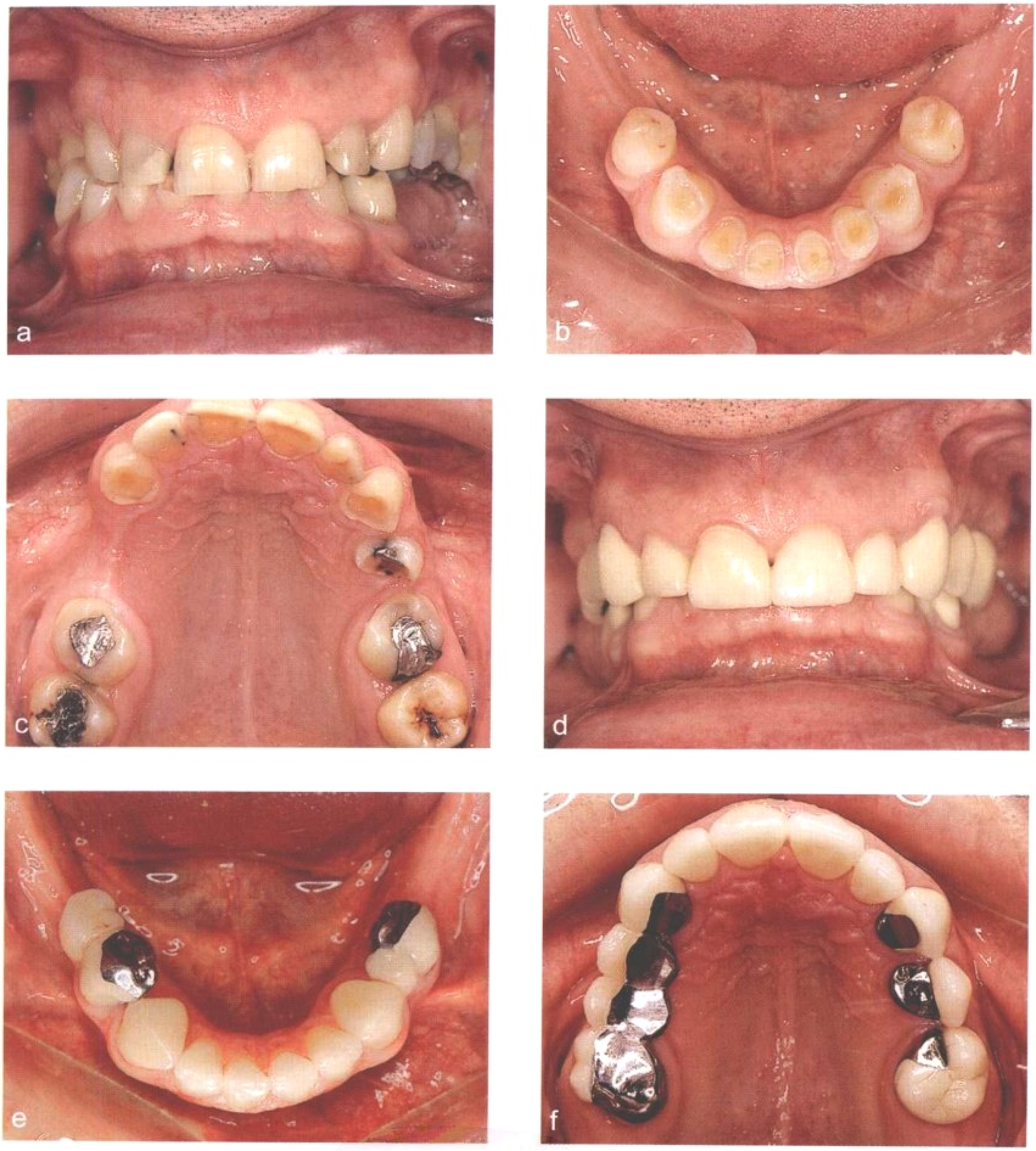


图 6-8 a. 牙齿磨损严重的患者唇面观，需重建法修复；b. 下牙弓；c. 上牙弓；d. 患者修复后的唇面观；e. 下牙弓修复后；f. 上牙弓修复后

Fig 6-8 (a) Labial view of patient with advanced toothwear, which requires a reorganized approach. (b) Lower arch. (c) Upper arch. (d) Labial view of patient posttreatment. (e) Lower arch of patient post-treatment. (f) Upper arch of patient posttreatment.

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制作前牙导板，这个导板可用于以后复制最终牙冠的导平面。

- 同样，可用记录了未来修复体形状和外观的临时冠作为标准。技师可以只参照这个标准，也可以根据常规的前牙导平面制作出和预计的修复体一模一样的最终冠桥修复体（图 6-8）。

customised anterior guidance table on the articulator, which can then be used to copy the guidance to the definitive crowns.

- Equally, an index can be made of the provisional crowns, which records the shape and contours of the planned restorations. The technician can use this alone or in tandem with the customised anterior guidance table to produce definitive crown(s) or bridgework that mirror the planned restorations (Fig 6-8).

拓展阅读
Further Reading

1 Brunton PA, Smith P, McCord JF, Wilson NHF. Procera all ceramic crowns: a new approach to an old problems? Br Dent J 1999;186:430–434

2 Brunton PA. Preparing anterior teeth for indirect restorations. Dent Update 2004;31: 131–136

3 McDonald A. Preparation guidelines for full and partial coverage ceramic restorations. Dent Update 2001;28:84–90

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第 7 章 美学缺陷和难题

Aesthetic Compromises and Dilemmas

目 的

失败是成功之母。本章的目的是研究美学的缺陷和难题，这样做是为了防患于未然，更是为了取得最佳的美学效果。

Aim

Success is a poor teacher. We learn a great deal from our mistakes. The aim of this section is to consider aesthetic compromises and dilemmas and in doing so prevent less than optimal outcomes.

要 点

通过阅读本章，临床医师将避免美学缺陷，还可以有效地应对常见的美学难题。

Outcome

On reading this section practitioners will be able to prevent aesthetic compromises and deal effectively with common aesthetic dilemmas.

引 言

在口腔修复学中有一种情况是一定会遇到的，那就是虽然所有的介入和治疗都做得非常的好，但是最终的修复体还是有可能失败。远期的失败是可以预见的，临床医师应该能说明修复体的使用寿命。辨证地看，患者在不知道使用寿命信息的情况下是不会同意治疗的。我们对美学失败的理解核心是：治疗过程完全按技术标准执行，但患者很可能仅从美学的角度就

Introduction

One thing certain in restorative dentistry is that all interventions and treatments, however well done, are ultimately likely to fail. Long-term failure is to be expected, and practitioners should be able to give an indication of the longevity of restorations. Arguably, without this information the consent process is not informed. Central to our understanding of aesthetic failures is that treatment can be well executed technically,

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认为该治疗是失败的。认识到失败很重要，但更重要的是如何通过判断预知并避免失败。本章将研究前牙修复体的各种美学缺陷和难题。

yet the patient can deem it a failure for aesthetic reasons alone. It is important, therefore, to consider failures, and more importantly to judge how to foresee and prevent them. Various pitfalls and dilemmas with the aesthetics of anterior restorations will be considered.

知情同意

知情同意过程的本质是讨论不同的治疗方案，并比较它们的风险、费用以及各种方案的优点。必须记住在美容牙科学中患者的要求通常高于他们的需求，这是与以确保口腔健康为目的的牙体治疗相比较而言的。因此，在必要的研究和讨论后，不进行任何处理也是治疗的一种选择。这样做有助于在对前牙做较大改变时，逐渐增加介入的程度，还有助于了解治疗风险、费用和好处（图 7-1）。如果漂白是一种可行的治疗方案，那么在这时让患者了解漂白过程的核心，就是告知患者目前漂白技术的合法状况。没有这些信息，就不可能取得患者的同意。

Informed Consent

Essential to the consent process is a discussion of alternative procedures and a comparison of the risks, costs and benefits of the various options. Bear in mind that aesthetic dentistry is something that patients generally request rather than something they need. This is in contrast to dental treatment needed to secure oral health. Consequently, doing nothing is also a treatment option that must be both considered and discussed. It is helpful to outline alternative treatments for the management of unsightly anterior teeth in terms of increasing levels of intervention, outlining the risks, costs and benefits (Fig 7-1). If bleaching is a possible treatment option then central to the consent for bleaching procedures at the present time is informing the patient of the current legal status of bleaching. Without this information the consent is not informed.

在美学处理中，重要的是患者的需求与你能够提供的治疗应当是一致的。当不能达成一致时，就会出现问

With aesthetic procedures it is important that what the patient requests and what treatment you can deliver are one and the

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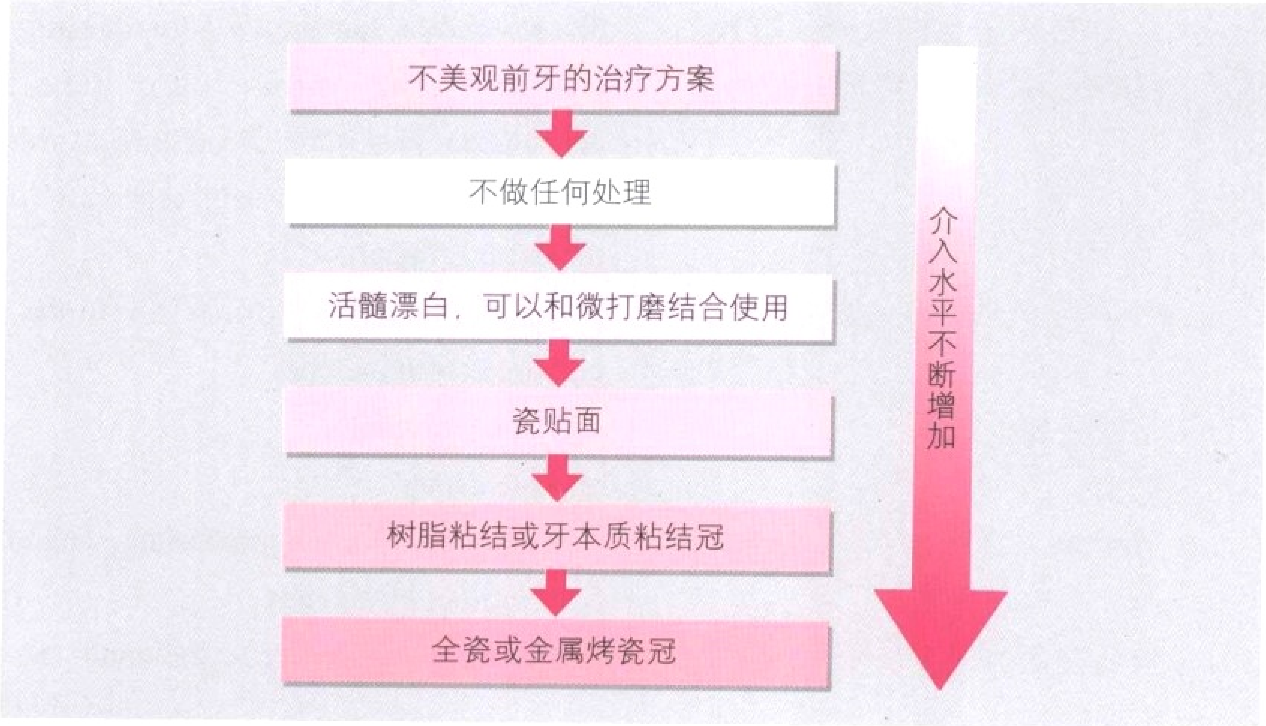


图 7-1　不美观前牙的治疗方案

Fig 7-1　Management strategies for unaesthetic anterior teeth.

题。患者可能寻求不切实际的治疗。在与患者讨论可能的治疗计划以后，治疗过程应该得到患者的同意并签署知情同意书。这个时候，医师应该为患者提供书面的治疗计划。这个阶段至关重要的是，患者对医患双方达成一致的治疗结果的理解和接受。如果这还有什么疑问的话，那么对这样的患者就要谨慎地推迟治疗。

same. Problems arise when this is not the case. Patients may attend seeking unrealistic treatments. Following a discussion as to what is possible, a course of action should be agreed and informed consent obtained. A written treatment plan should also be provided to the patient at this stage. Crucial to this process is an acceptance and understanding by the patient of what you have both agreed, – that is to say, what the treatment outcomes will be. If there is any doubt about this it might be prudent to decline to treat such patients.

单个牙

临床医师常常遇见单个牙变色或外伤的患者要求通过治疗来改善牙齿

The Single Tooth

Practitioners are not infrequently faced with the problem of a patient with a single

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的外观。这是临床上很难有效应付的情况，特别是当牙齿完整无缺的时候。

discoloured or damaged tooth requesting treatment to improve their dental appearance. This is a difficult clinical scenario to manage effectively, especially if the tooth is intact.

单个牙变色的治疗方案包括：

- 不做任何处理
- 漂白
- 微打磨，适当时可合并使用漂白，也可不漂白
- 冠或贴面修复

Treatment options for a single discoloured tooth include:

- doing nothing
- bleaching
- microabrasion, if appropriate, with or without bleaching
- crowning or veneering the tooth.

不做任何处理

不做任何处理是很少选择的治疗方案，只有当患者有特别的治疗要求时才用。但是，很重要的一点是千万不能答应患者超出你技术能力和经验之外的修复要求，不然的话，你成功的机会即使有也是极小的，而且对患者也有害。

Doing Nothing

Doing nothing is seldom an option when the patient has specifically requested treatment. However, it is important not to agree to provide treatment that is out of your range of skills and experience and you consider will have little, if any, chance of success or will be detrimental to the patient.

漂　白

如果牙齿已经失活，治疗方法就是直接用死髓漂白技术。如果牙齿是活髓，结构完整，那么就适合用活髓漂白技术。一种改良的漂白技术正在得到应用，即将过氧化脲放到一个有或无储药囊的牙托中，该牙托可以分段或从邻牙处截断。这种剪切可以限制漂白凝胶对邻牙的脱色。这样做通常都会奏效，但是对受影响牙的漂白作用却难以控制。最好是漂白了变色牙

Bleaching

If the tooth is non-vital, management is relatively straightforward using a nonvital bleaching technique. If the tooth is vital and structurally sound, then a vital bleaching technique may be indicated. A modified bleaching technique is used in that carbamide peroxide is placed in the splint which may or may not have a reservoir, with the splint sectioned or cut away from the adjacent teeth. The cut-away limits the extent

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之后，适当漂白整个牙弓，以弥补对邻牙的间接漂白作用。如果不宜对全牙列进行漂白，那么治疗单个变色牙的更易控制的方法是运用诊室漂白技术，同时接受这种技术的局限性。

to which bleaching gel changes the colour of the adjacent teeth. This will usually work, but it is difficult to limit the whitening to the affected tooth. It is probably better to whiten the discoloured tooth and then whiten the entire arch, if appropriate, to compensate for collateral bleaching of adjacent teeth. If bleaching of the entire arch is not appropriate, a more controlled way of treating a single discoloured tooth is to use an in-surgery technique, accepting the limitations of this technique.

微打磨，合并使用或不使用漂白技术

对于局部的表面着色，微打磨是一项非常实用的技术。能够通过微打磨去除的单颗牙局部着色的情况很少见。这种技术可以作为诊室漂白或活髓夜间漂白技术的适当补充。

Microabrasion With and Without Bleaching

Microabrasion can be a useful technique for localised superficial discolorations. Localised discolorations affecting a single tooth that could be amenable to microabrasion are rare. The technique can be supplemented with in-surgery or nightguard vital bleaching as appropriate.

冠或贴面修复牙

对于单个变色牙来说，冠修复可能是最好的修复方法了，包括有大面积修复体存在的牙。对于漂白效果不理想的变色健康牙或外形不美观的牙最好采用瓷贴面技术（图 7-2）。单个牙美容修复的困难之处在于几乎不可能做到与邻近的健康牙完全匹配。所以，最好采用间接修复体同时修复两个前牙。这就意味着有一颗健康的邻

Crowning or Veneering the Tooth

Crowning possibly best treats the single discoloured tooth, including extensive restorations. Discoloured sound teeth that have failed to respond to bleaching or have an atypical shape may best be managed with a porcelain laminate veneer (Fig 7-2). The difficulty with single-unit aesthetic restorations is that it is almost impossible to match them successfully to adjacent sound

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牙也需要预备，就会面临最小介入法的选择问题。为了减少介入的影响，可以用冠和贴面的联合修复（图7-3）。这种情况下，最重要的是要让患者理解，为什么要预备的是两颗牙而不是一颗牙。

teeth. Consequently it is preferable to treat pairs of anterior teeth with indirect restorations. This might mean an adjacent sound tooth being prepared, which flies in the face of a minimally interventive approach. To mitigate the effects of this a combination of a crown and veneer may be used (Fig 7-3). It is important in this situation that the patient understands why two teeth rather than one tooth need to be prepared.



图7-2　用死髓漂白技术漂白失败的变色牙。这种牙可能需要贴面修复，还可使用带金属或瓷底冠的全瓷冠来修复，因为它已变色

Fig 7-2　Discoloured tooth that has failed to whiten with non-vital bleaching. This tooth will need either a veneer or, more correctly due its discoloration, a crown with a coping of either metal or ceramic.

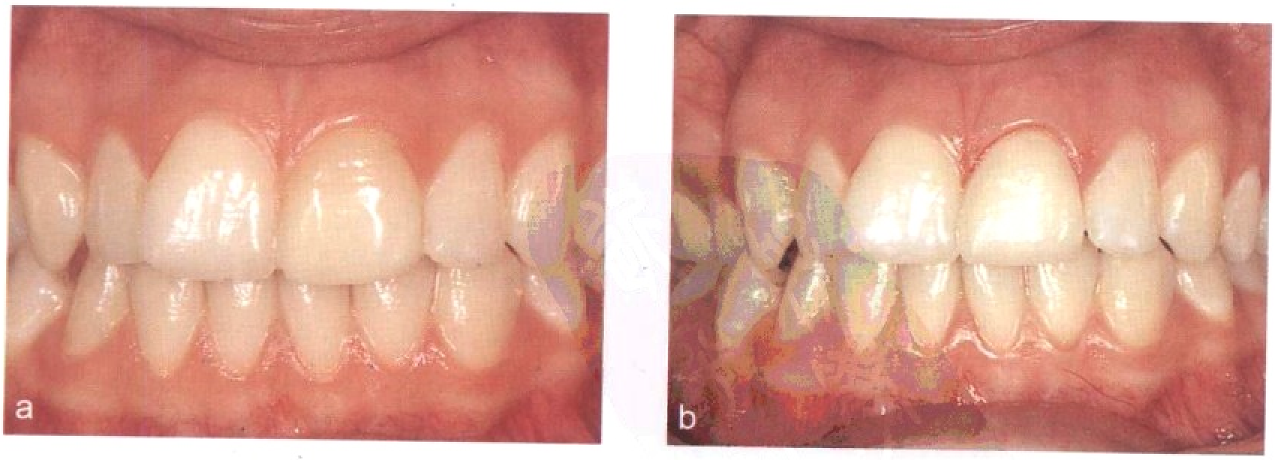


图7-3 a. 单个贴面修复左上中切牙，患者对外观不满意；b. 为患者更换贴面，同时可以看出，要做好一个很匹配的贴面到底有多难

Fig 7-3　(a) Patient with a single veneer on 21; the patient is unhappy with the appearance. (b) Replacement veneer for the patient illustrating how difficult it is to match one veneer.

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瓷贴面

经过多年的临床案例观察可以发现，如果病例选择、牙体预备和就位技术都选用得很好的话，瓷贴面就会取得良好的效果。但所有的修复体，无论哪种类型，都不可避免地在临床上存在失败的可能。补救的关键在于了解失败的原因。简单更换修复体很可能导致重复失败，这会打击你对自己技术的自信，也破坏了患者对你的信任。瓷贴面可能发生的各种失败这里都将考虑到，还要讨论补救措施，是需要修补原修复体，还是确保成功更换新的修复体。重要的是要注意许多瓷贴面修复的失败，同样会导致树脂或牙本质粘结冠的失败。大多数病例弥补失误的措施都是一样的。

Porcelain Laminate Veneers

Porcelain laminate veneers may be found to perform well in clinical service over a number of years if case selection, tooth preparation and placement techniques are optimal. Inevitably, all restorations, whatever their type, can deteriorate in clinical service. Central to remedying problems is an understanding of why the failure has occurred. Simply replacing the restoration will almost certainly result in a repeat failure, which will damage your confidence in the technique and your patient's confidence in you. The various types of failure that can occur with porcelain laminate veneers are considered here, and the remedial action necessary either to repair the restoration or to ensure success with a replacement restoration is discussed. It is important to note that many of the failures that occur with porcelain laminate veneers may also occur with resin- or dentine-bonded crowns. The treatment required to remedy the fault is similar in most cases .

临床操作中常见的失败

在有大面积修复体残存的牙齿上瓷贴面修复失败的可能性会增加，特别是残存的修复体明显与复合树脂修复体相邻接而不能被贴面完全覆盖时。有大面积修复体时需要采用混合型的

General Failure During Clinical Service

There is an increased incidence of failure of porcelain laminate veneers in teeth with (large) existing restorations. This occurs particularly when any existing restorations, notably proximal resin com-

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牙体预备，最好改用全冠覆盖技术。

树脂粘结剂的量不足可能导致钩边、边缘着色、界面渗漏，还可能引起早期难以诊断的龋坏。同样，糟糕的牙体预备技术也将导致修复体外形过突的问题。这样会使菌斑易于堆积，导致顽固性龈缘炎，这种龈缘炎很难治愈，更不必提前牙糟糕的美观效果了。

完全脱落

瓷贴面完全脱落可能由以下原因所致：

- 硅烷偶联剂的错误使用；特别是偶联剂的剂量不够，粘固后不久就可能发生失败。
- 用复合树脂粘结贴面时湿度控制不当，可能是粘结面被污染造成的，例如，将瓷贴面就位于石膏代型上检查其适合性。
- 当树脂粘固剂处于胶状期时贴面发生了移位。
- 贴面就位之前，树脂粘固剂的底

posite restorations, are not completely covered by the veneer. Extensive restorations require a hybridtype preparation or, preferably, a complete coverage technique.

Loss of resin-luting cement can lead to catches, marginal staining, interfacial leakage and possibly caries that can be difficult to diagnose in its early stages. Equally, poor preparation technique can lead to problems with the emergence profile of the restoration. This can facilitate plaque accumulation, leading to a recalcitrant marginal gingivitis, which is difficult to resolve – not to mention poor anterior aesthetics.

Complete Loss

Complete loss of a porcelain laminate veneer may occur as a result of the following reasons:

- Error in the use of the silane coupling agent; typically applying insufficient silane coupling agent – failure is likely to occur soon after cementation.
- Improper wetting of the laminate by the resin-luting composite, possibly subsequent to contamination of the fitting surface during, for example, placement of the porcelain laminate veneers on the stone die to check the fit.
- Movement of laminates when the resin-luting cement is at a gel stage.
- Resin-based tints or luting cements

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胶在手术灯光下暴露时间过长。这种现象在现代使用高亮度手术灯光的情况下相当普遍。

- 酸蚀不当。虽然很难评估，但是以下建议可能会有所帮助：
  - 绸缎样光滑的表面——酸蚀不够
  - 雾状表面——酸蚀合适
  - 白垩色表面——酸蚀过度
- 异常功能习惯或异常殆力。
- 外伤也可以造成贴面的完全脱落。

龈缘炎

邻近牙龈组织的慢性炎症可导致美观效果差，特别是笑线过高的患者。瓷贴面引起的牙龈炎症可能和以下一个或几个因素有关：

- 抛光技术差留下凸凹不平的缺陷。这种情况通常发生在使用低黏度的树脂粘固剂的时候，特别容易不经意地留下过多的树脂粘固剂。
- 即使抛光技术非常出色，在贴面龈下就位时也经常会导致一定

exposed to the surgery lights for extended periods of time, prior to placement of the laminate. This is a relatively common problem with modern-day high-intensity operating lights.

- Improper acid etch. This can be difficult to assess; however, the following may be useful guide:
  - satin appearance–under-etched
  - frosted appearance–proper etch
  - chalky appearance–over-etched
- Parafunctional habit or atypical occlusal loading.
- Trauma can result in complete loss of a laminate veneer restoration.

Marginal Inflammation

Chronic inflammation of the adjacent gingival tissues will result in poor aesthetics, notably in patients with a high smile line. Gingival inflammation associated with porcelain laminate veneers may be the result of one or several of the following factors:

- Poor finishing techniques leaving residual positive or negative discrepancies. This can commonly occur when a low-viscosity resin luting cement has been used. It is especially easy to leave an excess of resin-luting cement inadvertently.
- Placing laminates subgingivally even with excellent finishing techniques

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程度的牙龈炎症，何况还加上了取模和就位阶段，特别是要达到良好隔湿带来的困难。如果边缘位于牙本质或牙骨质上，问题就更复杂了。

will usually cause some gingival inflammation, let alone invite other difficulties at the impression and placement stages, notably achieving good moisture control. Matters are further complicated if the margin is on dentine or cementum.

- 不良的或不相称的口腔卫生状况。

- Inadequate or inappropriate oral hygiene.

补救措施包括更换贴面或重新抛光边缘，以减少炎症的发生。

Remedial treatment involves replacing the laminates or refinishing the margins subsequent to concerted action to minimise the inflammation.

贴面过凸

牙体预备足够的话，瓷贴面修复能再现牙齿的原貌。牙体预备不足就会导致贴面过凸，患者可能无法接受（图7-4）。贴面过凸可以归因于以下几点：

Bulky Laminates

With adequate tooth preparation a porcelain laminate veneer restoration should reproduce the original contours of the tooth. Failure to do so can result in overbuilt or bulky laminate veneers, which the patient may find hard to tolerate (Fig 7-4). Bulky laminate veneers can be due to the following:

- 粘固阶段就位不精确。这在牙体预备不足时最可能发生，粘固过程中缺乏加压就位也会导致这种情况。
- 复合树脂粘固剂使用过多，贴面就位后粘固剂大约0.1 mm厚就可以了。
- 贴面设计得太厚。理想状况下，

- Inaccurate placement at the cementation stage. This is most likely to happen when the tooth has been inadequately prepared and there is a lack of a positive seat during cementation as a consequence.
- Use of too much resin composite luting cement, which should be approximately 0.1mm thick after seating.
- Laminate design is too thick. Ideally,

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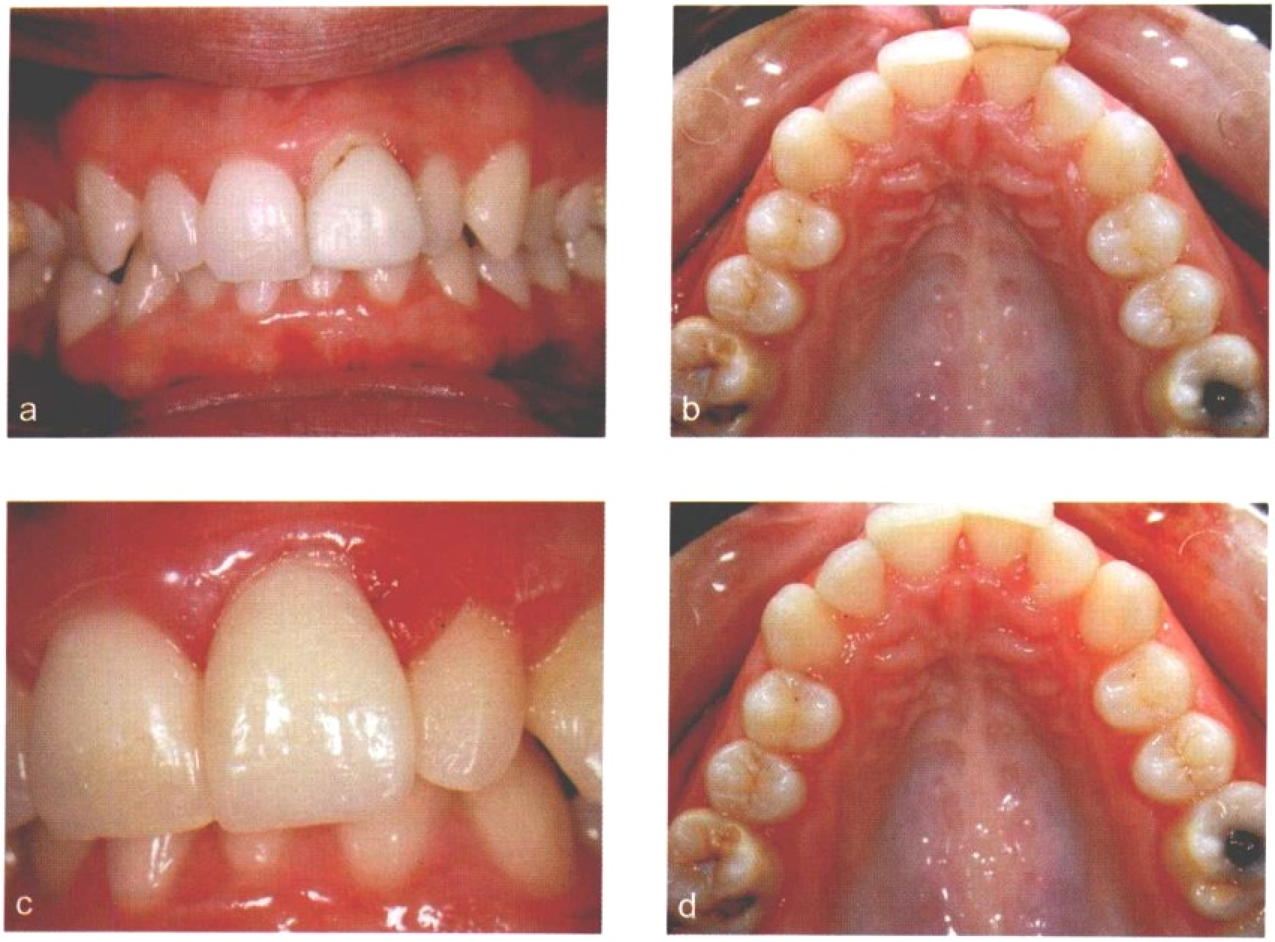


图 7-4 a. 贴面过凸，边缘状况差。注意远中的炎症；b. 殆面观明显过凸的切缘；c. 改进了外形的新的瓷贴面；d. 患者的殆面观修复后显示外观得到了改善

Fig 7-4 (a) Bulky laminate with poor margins. Note inflammation on the distal aspect. (b) Occlusal view emphasising the incisal bulk. (c) New porcelain laminate veneer with improved emergence profile. (d) Occlusal view of patient post-treatment shows improved contour.

贴面体部应该约 0.4 mm 厚，边缘约 0.1 mm 厚。由于牙体预备不足，技师们常常不得不将牙体恢复得过凸。

- 贴面在技工室进行了不正确的调磨和抛光。
- 贴面重新就位时没有将原有的修复体和粘结剂完全去除干净。

the body of the laminate should be approximately 0.4mm thick and at the margins approximately 0.1mm thick. Frequently the technician has to bulk the tooth out due to inadequate preparation.

- Incorrect trimming and finishing of laminate in the laboratory.
- Replacement laminates placed without complete removal of the original restoration along with the luting cement.

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过凸贴面的补救措施就是更换修复体。

Remedial treatment for bulky laminates is to replace the restoration.

贴面剥离

贴面从边缘处开始剥离，可能由于以下原因：

- 就位时边缘没有封闭。
- 与贴面边缘不适合或树脂粘固剂过量有关，修复体就位时粘固剂的厚度大约为 0.1 mm。
- 粘结剂层，也就是非充填树脂太厚，并且在粘结系统的这一层中有裂纹扩散。
- 贴面在粘固时就位不当，可能造成邻接点的粘连。

补救措施就是更换瓷贴面。

Peeling of Laminate

If the laminate veneer starts to "peel" at the margins this is can be due to one of the following:

- Margins not sealed at placement stage.
- Ledging related to improper laminate adaptation or excessive resin luting cement, which should be approximately 0.1mm thick when the restoration is seated.
- Layer of bonding agent — that is to say, unfilled resin — is too thick and there has been cohesive crack propagation in this layer of the adhesive system.
- Improper seating of the laminate at the cementation stage, possibly as a consequence of binding at the proximal contacts.

Remedial treatment is the replacement of the porcelain laminate veneer.

贴面表面有白色斑纹

白色斑纹会影响贴面的美观效果。通常由以下原因造成：

- 树脂粘固层架空，这是由于贴面就位时用力过大造成的。过大的压力意味着复合树脂不能正常

White Flecks Under Laminate Surface

White flecks can affect the aesthetic outcome of laminate veneer restorations. They are usually due to one of the following:

- A void in the resin luting cement layer, which is due to too much pressure having been applied to the laminate dur-

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流动，造成“回弹效应”，常发生在边缘处。

ing placement. Excessive pressure means that the resin composite cannot flow normally and a “rebound effect” occurs, typically often at the margins.

- 错误地或者过量地使用了遮色剂。

- Improper or excessive placement of opaquers.

对白色斑纹的补救措施就是更换贴面。

Remedial treatment for a white fleck is to replace the laminate restoration.

边缘着色

贴面的预备边缘在龈上或平齐龈缘都会增加边缘显露的可能性。结果导致修复体边缘界面周围着色，影响美观。当然这可能和使用了双重固化或化学固化复合树脂粘固剂有关。边缘界面着色或变色可以归于以下原因：

- 贴面边缘过凸，且不够适合，使得暴露的复合树脂在过量的茶或咖啡中着色。
- 边缘抛光不完全留下复合树脂“边”。这通常发生在使用低黏度的粘固剂时。
- 口腔卫生差，贴面护理差。

补救措施包括指导患者进行贴面

Marginal Staining

The trend toward supra- or juxtagingival preparation margins for laminate veneers increases the likelihood of the margins being visible. Consequently, staining around the marginal interface of the restoration compromises the aesthetics. This can, of course, be compounded by the use of dual or chemically cured resin-composite luting cements. Staining or discoloration of the marginal interface may occur as a result of the following:

- Veneer is too bulky at margins and not closely adapted, which allows staining of exposed resin-composite lute by more-than-average tea or coffee drinking.
- Incomplete finishing of the margins leaving a resin composite “rim”. This commonly occurs when using low-viscosity luting cements.
- Poor oral hygiene and care of laminates.

Remedial treatment includes instructing

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护理（如正确刷牙和使用牙线）。用水冷的高速细砂金刚砂钻轻轻重新抛光边缘，可能会去除多余的粘固剂，并重新修整现有的界面。双重固化或化学固化的复合树脂粘固剂含有一种叔胺化学引发剂，时间长会发生变色。当底层的粘固剂变色时，还可导致边缘着色和贴面变暗。

the patient on laminate care (for example, proper brushing and flossing). Light refinishing of margins with fine-grade water-cooled high-speed diamond burs may be required to remove excess lute and refurbish the existing interface. Dual- or chemically cured resin composite luting cements containing a tertiary amine as chemical initiator may discolour over time. This can result in both marginal staining and darkening of a laminate as the underlying luting cement discolours.

切角或边缘折裂

这种情况发生，通常是病例评估失误所致，很少是因为修复体存在技术缺陷。一般情况下，就位后不久就发生的折裂很可能是殆关系处理不当造成的。而粘固很多年之后发生的折裂，很可能是应力疲劳的原因。造成切角折裂的其他原因还包括：

- 异常殆力。
- 异常功能习惯（如咬指甲）。
- 贴面没有“包绕”切角。
- 贴面止于唇切线角处。
- 在粘固后的最初24 h内患者使用过大的咬合力。

小的折裂可以用复合树脂修复。

Incisal Angle or Edge Fracture

If this occurs, it is usually a consequence of poor case assessment and rarely a technical deficiency in the restoration. As a general rule, fracture soon after placement is likely to be a consequence of poor occlusal management. In contrast, fracture after many years of service is probably as a result of stress fatigue. Other causes of incisal angle fracture include:

- Atypical occlusal loading.
- Parafunctional habits (for example, nail biting).
- Veneer does not “wrap around”.
- Veneer finished at labial incisal line angle.
- Patient applies excessive biting forces during the initial 24-hour period immediately after placement.

Small fractures can be repaired with resin

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另一种方法就是重做贴面。如果怀疑是殆关系的问题，那么必须小心地借助半可调式殆架，借助面弓固定上颌模型，记录正中关系和前伸殆关系来重新制作贴面。

composite. The other option is to replace the laminate. If an occlusal problem is suspected it is prudent to make the replacement with the aid of a semi-adjustable articulator and the maxillary cast mounted with the aid of a facebow and programmed with centric and protrusive occlusal records.

复合树脂薄层技术

Resin-Composite Laminate Techniques

因为直接美容复合树脂修复技术的成功，间接复合树脂贴面技术如今已经很少使用了。直接或间接复合树脂贴面修复在临床上都存在某些特殊的问题，这些问题包括：

- 整个贴面着色。
- 唇侧磨损。

Indirectly placed resin-composite veneers are rarely used today because of the success of directly placed aesthetic resin composites. Directly or indirectly placed resin-composite laminate veneers have certain specific problems in clinical service. These are as follows:

- Staining of the entire laminate.
- Wear of the labial surface.

整个贴面着色

这种情况只发生在贴面是由复合树脂制作时。补救措施包括重新抛光或重新打磨修复体或用瓷或烤瓷重新制作贴面。

Staining of Entire Laminate

This only occurs when the laminate veneer has been made of resin composite. Remedial treatment includes refinishing or refurbishing the restoration or remaking the laminate using porcelain or ceramic.

唇侧磨损

用复合树脂制作的贴面的特征之一就是易磨损。这种情况通常由以下的一个因素或两个因素共同作用而产生：

Wear of the Labial Surface

Wear tends to be a feature of laminate veneers made of resin composite. It occurs as a consequence of one or a combination of the following:

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- 使用研磨剂过多或硬质牙刷。
- 过分或过于频繁地刷牙。

补救措施包括重新制作瓷或烤瓷贴面，或者简单地直接添加复合树脂以达到修复的目的。

- Use of extremely abrasive dentifrice or a hard toothbrush.
- Overzealous or too frequent tooth-brushing.

Remedial treatment would include re-making the laminate restoration using porcelain or ceramic or simply the addition of an increment of resin composite to effect a repair.

冠或桥体折裂

当患者出现前牙冠或桥体折裂时，重要的是在考虑各种不同的修复治疗方案之前要首先诊断失败的原因。一个或多个单位的修复体的折裂，特别是在粘固之后不久发生的折裂，很可能是由于殆力过大造成的。修复数年之后发生的折裂，则可能是材料的应力疲劳或创伤所致。对前牙冠或桥折裂的处理通常局限于以下几点：

- 直接修复缺陷，一般选用颜色合适的复合树脂材料，辅以某种粘结系统来进行修复。正常情况下，这只是一种中短期的修复，因为重做是不可避免的。
- 大面积的折裂需要重做修复体。

Fracture of Crowns and Bridgework

When a patient presents with fracture of anterior crown or bridgework, it is important to diagnose the reason for failure before considering the various treatment options. Fracture of the unit or units, particularly soon after cementation, is probably because of excessive occlusal loading. Fracture of the restoration after years of clinical service is likely to be a consequence of stress fatigue of the material or trauma. The treatment for a fracture of an anterior crown or bridge is usually confined to the following:

- Direct restoration of the defect, most commonly with suitably shaded resincomposite restorative material placed with the aid of an adhesive system. This is normally a short- to medium-term repair, as a replacement is inevitable.
- Larger fractures will require restora-

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预防冠桥折裂最好遵循以下原则：

- 在修复体就位的时候评估患者的𬌗关系，包括在预备和精修阶段使用咬合纸。
- 不要将预备体的边缘放在静态或动态的咬合接触区。
- 咬合接触区要适当调𬌗（图 7-5a）。
- 在非典型𬌗力区选择适合的材料（图 7-5b）。

冠桥折裂的口内修补

直到现在，烤瓷或全瓷冠或桥的折裂的修补还是非常困难。通常的修补只是暂时的，最终还是要重新制作

tion replacement.

Prevention of fracture of crowns and bridgework is best achieved by:

- Assessing the patient's occlusion at restoration placement to include the use of articulating paper at the preparation and finishing stages.
- Not placing preparation margins in static or dynamic occlusal contact areas.
- Adequate occlusal reduction in occlusal contact areas (Fig 7-5a).
- Selection of an appropriate material where there is atypical occlusal loading (Fig 7-5b).

Intraoral Repair of Fractured Crowns and Bridgework

Fractures of the porcelain or ceramic of crowns or bridgework have until recently been very difficult to repair. Repairs were

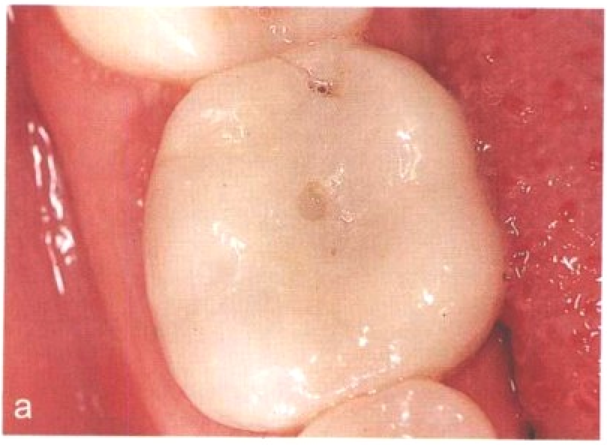




图 7-5　a. 调𬌗不当导致全瓷冠折裂；b. 新的用了更薄的 Procera®内冠的全瓷冠

Fig 7-5　(a) Inadequate occlusal reduction leading to fracture of an all-ceramic crown. (b) New all-ceramic crown for the patient using a thinner Procera® coping.

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修复体来确保预期的美观效果。新的更好的粘结系统的出现，口内对烤瓷、瓷以及金属树脂，即粘在金属上的树脂的处理（酸蚀和喷砂），以及对烤瓷或瓷的硅烷化处理已经改变了这种状况。最新的技术和材料已经为临床医师提供了在口内修补折裂的冠桥的可行性。

在决定是否要修补折裂的冠桥以前，很重要的是要先考虑以下几点：

- **桥的临床状态**：修补只有在冠桥的其他方面都很满意的情况下才有必要。边缘渗漏、桥体严重折裂和（或）有继发龋发生，都是冠桥要重新制作的典型指征。
- **𬌗因素**：当患者出现崩瓷的时候这一点尤其重要，这暗示在前伸𬌗和侧方𬌗时存在𬌗干扰，这些问题在粘固之前检查𬌗关系时常常被忽略，而只检查正中关系并调𬌗。强烈推荐在固位时正中和非正中关系都要检查并适当调𬌗，这样应该可以避免以后的崩瓷。同样，在随后的修补中，也要仔细检查𬌗关系。

frequently short-lived and ultimately the restoration required replacement to guarantee a predictable aesthetic result. The advent of newer, more predictable adhesive systems, intraoral conditioning treatments (etching and sandblasting) for porcelain, ceramic and metal coupled with resins that adhere to metal and silanised porcelain or ceramic have changed this. The newer techniques and materials now offer practitioners the possibility of predictable intraoral repair of fractured crowns and bridgework.

Before deciding whether to repair a fractured crown or bridge it is important to consider the following:

- **Clinical condition of the bridge:** A repair should only be undertaken when the bridge or crown is clinically satisfactory in all other respects. Leaking margins, catastrophic fracture of the bridge and/or secondary caries will typically dictate that the bridge or crown is replaced.
- **Occlusal factors:** This is of particular importance when a patient presents with fractured porcelain or ceramic, which is frequently suggestive of an occlusal interference during protrusive and lateral excursions. These are often overlooked when the occlusion is checked prior to cementation, with only centric occlusal stops checked and adjusted. It is strongly recom-

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mended that both centric and excursive occlusal contacts are checked and adjusted appropriately at the time of placement, and this should prevent subsequent fracture of the porcelain or ceramic. Equally, following repair the occlusion should be checked carefully.

- **从粘固到折裂的时间**：一般情况下，折裂发生在粘固之后不久可能是由于殆关系的问题。折裂发生在使用很久之后通常提示应力疲劳。

- **Time to fracture from cementation:** As a general rule fracture soon after cementation is likely to be due to an occlusal problem. Fracture after a long period of use is usually suggestive of stress fatigue failure.

- **利用折裂片**：如果折裂的瓷片还可用，那么选用适当的粘结剂，在酸蚀后涂硅烷偶联剂就可将瓷片重新粘回原处。

- **Fractured portion available:** If the fractured piece of porcelain or ceramic is available it can be bonded back into place, using a suitable bonding agent, after being etched and coated with a silane-coupling agent.

- **折裂处的性质**：如果口内折裂处主要是金属，那么就需要使用对金属有特别的亲和力的粘结介质如 4–META 型树脂粘结剂。一般还需要用到树脂遮色剂，特别是在需要用颜色较浅的复合树脂来修补时。如果折裂处主要是瓷只伴有少量的金属暴露，在口内酸蚀瓷就足以保证复合树脂的修补固位了。

- **Nature of the fracture site:** If the intraoral fracture site is predominately metal a bonding agent with a special affinity for metal, such as a 4-META type of resin, will be required. Commonly, a resin opaquer will also be required–in particular, when a lighter shade of resin composite is needed for the repair. If the fracture site is predominately porcelain or ceramic with a small amount of metal exposed then intraoral etching of the porcelain or ceramic will be sufficient to retain the resin composite repair.

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- **折裂范围**：折裂的瓷片小通常更适合用复合树脂修补。而当折裂面积较大时，一般要求重新制作冠桥。更大面积的桥体崩瓷的美容修补方法还有，将桥体留在口内预备折裂牙，制作瓷贴面或金属烤瓷冠。

- **Extent of the fracture:** Minimal fractures of porcelain or ceramic are more amenable to repair with resin composite, while more extensive fractures will usually require replacement of the bridgework or crown. Other methods to affect an aesthetic repair of more extensive bridgework porcelain fractures include preparation of the fractured tooth while leaving the bridgework in place, for either a porcelain laminate veneer or another metal ceramic crown.

- **早期折裂史**：对于以前修补过的桥冠再次失败，建议最好在诊断明确了再次失败的原因之后，再重做冠桥。

- **History of previous fracture:** It is suggested that repeat failure of a previously repaired bridge or crown is better treated with a replacement crown or bridge after the reason for repeated failure has been diagnosed.

修补材料

有许多桥修补套装可供临床医师使用。这些产品通常包括：

- 氢氟酸（9.5%）或酸性氟磷酸盐（1.23%）用于口内瓷酸蚀。
- 一种硅烷偶联剂。
- 金属粘结介质（如4–META型树脂）。
- 一种遮色树脂，在需要时用来遮盖底层金属。
- 一种非充填树脂。

Repair Materials

A variety of bridge repair kits are available to the practitioner. These products commonly include the following:

- Either hydrofluoric acid (9.5%) or acidulated phosphate fluoride (1.23%) for intraoral etching of porcelain.
- A silane-coupling agent.
- A metal bonding agent (for example, a 4-META type resin).
- An opaque resin to obscure underlying metalwork if required.
- An unfilled resin.

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• 间充高密度树脂用于最后的修补。

Cojet™(3M ESPE UK Ltd)是一种全新的材料，已经引入到复合树脂和瓷折裂的修补处理中（图 7-6a）。这种通用系统不需要口内酸蚀材料并有其他用途，即，在使用树脂粘固剂粘固之前，作为一种复合树脂、瓷和金属修复体的渗透液使用。该系统以硅化砂为中心，这种砂既能在口内也能在口外，对复合树脂、瓷和金属表面进行预处理。这种砂（氧化铝）粒的直径为 30 μm，它外层是二氧化硅，置于微型喷砂机中，压力为（2～3 bar，30～42psi）（1 bar=100 kPa，1 psi=

• A midway-filled densified resin composite for the ultimate repair.

Cojet™ (3M ESPE UK Ltd), a novel material, has been introduced for the management of fractured resin composite and ceramic restorations (Fig 7-6a). This versatile system does not require an intraoral etchant material and has additional uses, namely pretreatment of resin composite, ceramic and metal restorations prior to cementation with a resin-luting cement. The system revolves around silicatised sand, which can be used both intra-and extraorally to pretreat resin-composite, ceramic and metal surfaces. The sand (aluminium

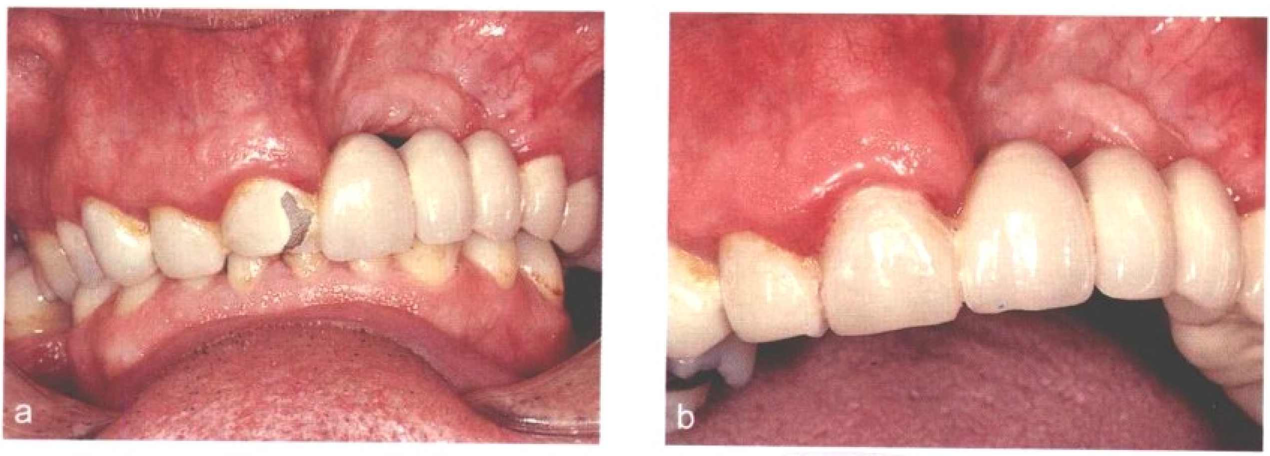




图 7-6　a. 右上中切牙发生崩瓷；b. 用 Cojet™ 修补后的效果；c. 龈贴面就位

Fig 7-6 (a) Porcelain fractured from upper right one (11). (b) Post-op view following repair with Cojet™. (c) Gingival veneer in place.

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6.89 kPa)，在折裂处喷射 15 s。砂粒以很大冲击力撞击处理面产生机械粗化表面。产生的高能量使二氧化硅颗粒熔化，并发生摩擦润滑化学作用嵌入基材下 15 μm深，同时砂粒被吸走。接着涂布硅烷偶联剂到处理过的表面上，使得复合树脂粘固剂或修复材料能够附着其上（图 7-6b，c）。使用该材料修补的各个步骤已经列举在表 7-1 中。

oxide), particle size 30μm, which is coated with silicone dioxide, is placed in a mini-sandblaster under pressure (2-3 bar, 30-42 psi) and the fracture site treated for 15 seconds. The particles of sand hit the surface with a very high impact energy, which mechanically roughens the surface. The high energy generated causes the silicone dioxide particles to melt and become incorporated "tribochemically anchored" into the substrate surface up to a depth of 15 μm while the sand particles are aspirated away. Subsequent application of a silane-coupling agent to this modified surface allows the attachment of a resin composite luting cement or restorative material (Fig 7-6b,c). The various stages for using this material to repair restorations are illustrated in Table 7-1.

表 7-1 用 Cojet™ (3M ESPE) 修补崩瓷的瓷和金瓷修复体的步骤

Table 7-1 Procedure for repairing fractured porcelain and metal-ceramic restorations with Cojet™ (3M ESPE)

瓷修复体	金瓷修复体
1．使用橡皮障	1．使用橡皮障
2．患者和操作者都需佩戴安全眼镜	2．患者和操作者都需佩戴安全眼镜
3．喷砂（Cojet™ 砂）需修补的瓷面 15 s	3．喷砂需修复的瓷面 15 s
4．硅烷处理 30 s，吹干	4．硅烷处理 30 s，吹干
5．应用非充填树脂，光固化 20 s	5．用遮色剂覆盖金属，光固化 10 s
6．添加复合树脂，光固化 40 s	6．应用非充填树脂，光固化 20 s
7．用精细的高速水冷钻抛光	7．添加复合树脂，光固化 40 s
	8．用精细的高速水冷钻抛光

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Further Reading

Robbins JW. Intraoral repair of the fractured porcelain restoration. Operat Dent 1998; 23:203–207

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